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Introduction

Excel All-in-One For Dummies brings together plain and simple information on using all aspects of Microsoft Excel. It's designed to be of help no matter how much or how little experience you have with the program. As the preeminent spreadsheet and data analysis software for all sorts of computing devices running Windows (desktops, laptops, tablets, and even smartphones), Excel offers its users seemingly unlimited capabilities too often masked in technical jargon and obscured by explanations only a software engineer could love. On top of that, many of the publications that purport to give you the lowdown on using Excel are quite clear on how to use particular features without giving you a clue as to why you would want to go to all the trouble.

The truth is that understanding how to use the abundance of features offered by Excel is only half the battle, at best. The other half of the battle is to understand how these features can benefit you in your work; in other words, "what's in it for you." I have endeavored to cover both the "how to" and "so what" aspects in all my discussions of Excel features, being as clear as possible and using a minimum of tech-speak.

Fortunately, Excel is well worth the effort to get to know because it's definitely one of the best data-processing and analysis tools that has ever come along. From let-Excel-do-all-the-work features such as Flash Fill and Analyze Data to eyebrow-raisingly powerful tools such as PivotTables and Solver, Excel has whatever you need to get your numbers crunched. Excel is a blast to use when you know what you're doing, and my great hope is that this "fun" aspect of using the program comes through on every page (or, at least, every other page).

About This Book

As the name states, *Excel All-in-One For Dummies* is a reference (whether you keep it on your desk or use it to prop up your desk is your business). This means that although the chapters in each book are laid out in a logical order, each stands on its own, ready for you to dig into the information at any point.

As much as possible, I have endeavored to make the topics within each book and chapter stand on their own. When there's just no way around relying on some information that's discussed elsewhere, I include a cross-reference that gives you the chapter and verse (actually the book and chapter) for where you can find that related information if you're of a mind to.

Use the full Table of Contents and Index to look up the topic of the hour and find out exactly where it is in this compilation of Excel information. You'll find that although most topics are introduced in a conversational manner, I don't waste much time cutting to the chase by laying down the main principles at work (usually in bulleted form) followed by the hard reality of how you do the deed (as numbered steps).

Foolish Assumptions

I'm only going to make one foolish assumption about you, and that is that you have some need to use Microsoft Excel under Windows in your work or studies. If pushed, I further guess that you aren't particularly interested in knowing Excel at an expert level but are terribly motivated to find out how to do the stuff you need to get done. If that's the case, this is definitely the book for you. Fortunately, even if you happen to be one of those newcomers who's highly motivated to become the company's resident spreadsheet guru, you've still come to the right place.

As far as your hardware and software go, I'm assuming that you already have Excel installed on your computing device running under Windows. And it doesn't matter whether you obtained Excel with a Microsoft 365 subscription or an Office 2021 purchase; this book covers the core functionality of both flavors of Excel.

I'm not assuming, however, that when you're using Excel that you're sitting in front of a large screen monitor and making cell entries and command selections with a physical keyboard or connected mouse. With the introduction of Microsoft's Surface 4 tablet and the support for a whole slew of different Windows tablets, you may well be entering data and selecting commands with your finger or stylus using the Windows Touch keyboard and Touch pointer.

To deal with the differences between using Excel on a standard desktop or laptop computer with access only to a physical keyboard and mouse and a touchscreen tablet or smartphone environment with access only to the virtual Touch keyboard, I've outlined the touchscreen equivalents to common commands you find throughout the text, such as “click,” “double-click,” “drag,” and so forth, in the section that explains selecting by touch in Book 1, Chapter 1.

Warning: Because of the diversity of the devices that Excel runs on and the places where its files can be saved and used, if you’re using Excel 2007 or Excel 2010 for Windows, much of the file-related information in this book may only confuse and confound you. If you’re still using a version prior to Excel 2007, which introduced the Ribbon interface, this edition will be of no use to you because your version of the program works nothing like what this book describes.

Conventions Used in This Book

This book follows a number of different conventions modeled primarily after those used by Microsoft in its various online articles and help materials. These conventions deal primarily with Ribbon command sequences and shortcut or hot key sequences that you encounter.

Excel is a sophisticated program that uses the Ribbon interface first introduced in Excel 2007. In Chapter 1, I explain all about this Ribbon interface and how to get comfortable with its command structure. Throughout the book, you may find Ribbon command sequences using the shorthand developed by Microsoft whereby the name on the tab on the Ribbon and the command button you select are separated by arrows, as in

Home ⇒ Copy

This is shorthand for the Ribbon command that copies whatever cells or graphics are currently selected to the Windows Clipboard. It means that you click the Home tab on the Ribbon (if it’s not already displayed) and then click the Copy button, which sports the traditional side-by-side page icon.

Some of the Ribbon command sequences involve not only selecting a command button on a tab but then also selecting an item on a drop-down menu. In this case, the drop-down menu command follows the name of the tab and command button, all separated by arrows, as in

Formulas ⇒ Calculation Options ⇒ Manual

This is shorthand for the Ribbon command sequence that turns on manual recalculation in Excel. It says that you click the Formulas tab (if it's not already displayed) and then click the Calculation Options command button followed by the Manual drop-down menu option.

The book occasionally encourages you to type something specific into a specific cell in the worksheet. When I tell you to enter a specific function, the part you should type generally appears in **bold** type. For example, **=SUM(A2:B2)** means that you should type exactly what you see: an equal sign, the word **SUM,** a left parenthesis, the text **A2:B2** (complete with a colon between the letter-number combos), and a right parenthesis. You then, of course, still have to press the Enter key or click the Enter button on the Formula bar to make the entry stick.

When Excel isn't talking to you by popping up message boxes, it displays highly informative messages in the Status bar at the bottom of the screen. This book renders messages that you see onscreen like this:

```
CALCULATE
```

This is the message that tells you that Excel is in manual recalculation mode (after using the earlier Ribbon command sequence) and that one or more of the formulas in your worksheet are not up to date and are in sore need of recalculation.

Occasionally I give you a *shortcut key combination* that you can press to choose a command from the keyboard rather than clicking buttons on the Ribbon with the mouse. Shortcut key combinations are written like this: Alt+FS or Ctrl+S. (Both of these shortcut key combos save workbook changes.)

With the Alt key combos, you press the Alt key until the shortcut key letters appear in little squares all along the Ribbon. At that point, you can release the Alt key and start pressing the shortcut key letters. (By the way, these are all lowercase shortcut key letters — I only put them in caps to make them stand out in the text.)

Shortcut key combos that use the Ctrl key are of an older vintage, and they work a little bit differently because, on a physical keyboard, you have to hold down the Ctrl key as you press the shortcut key letter. (Again, unless you see the Shift key in the sequence as in Ctrl+Shift +C, don't worry about uppercase letters.)

Finally, if you're really observant, you may notice a discrepancy between the capitalization of the names of dialog box options (such as headings, option buttons, and check boxes) as they appear in the book and how they actually appear in Excel on your computer screen. I intentionally use the convention of capitalizing the initial letters of all the main words of a dialog box option to help you differentiate the name of the option from the rest of the text describing its use.

Icons Used in This Book

The following icons are strategically placed in the margins throughout all eight books in this volume. Their purpose is to get your attention, and each has its own way of doing that.

TIP This icon denotes some really cool information (in my humble opinion) that will pay off by making your work a lot more enjoyable or productive (or both).

REMEMBER This icon denotes a tidbit that you ought to pay extra attention to; otherwise, you may end up taking a detour that wastes valuable time.

WARNING This icon denotes a tidbit that you ought to pay extra attention to; otherwise, you'll be sorry. I reserve this icon for those times when you can lose data and otherwise screw up your spreadsheet.

TECHNICAL STUFF This icon denotes a tidbit that makes free use of (oh no!) technical jargon. You may want to skip these sections (or, at least, read them when no one else is around).

Beyond the Book

- **Examples:** This book’s sample Excel workbooks can be found at `www.wiley.com/go/excel2022aiofd` or at my website (`www.paulmcfedries.com`). The filenames of the workbooks used in the book's examples are given in the text.
- **Cheat Sheet:** To locate this book's Cheat Sheet, go to `www.dummies.com` and search for *Excel All-in-One For Dummies.* See the Cheat Sheet for info on Excel shortcut keys, keyboard cell-selection techniques, setting regional dates, and sharing workbooks from OneDrive.

Where to Go from Here

The question of where to go from here couldn’t be simpler: Go to Book 1, Chapter 1 and find out what you’re dealing with. Which book you go to after that is a matter of personal interest and need. Just go for the gold and don’t forget to have some fun while you’re digging!

Book 1

Excel Basics

Contents at a Glance

Chapter 1: Excel: The 50-Cent Tour

- A Bird's-Eye View of Excel
- Checking Out Excel's Start Screen
- Getting Comfy with the Excel User Interface
- Getting Help
- Launching and Quitting Excel

Chapter 2: Customizing Excel

- Tailoring the Quick Access Toolbar to Your Tastes
- Exercising Your Options
- Using Office Add-ins
- Using Excel's Own Add-ins

Chapter 1

Excel: The 50-Cent Tour

IN THIS CHAPTER

- **Getting to know Excel’s Start screen and program window**
- **Selecting commands from the Ribbon**
- **Unpinning the Ribbon**
- **Using Excel on a touchscreen device**
- **Getting around the worksheet and workbook**
- **Using Excel’s Tell Me feature when you need help**
- **Launching and quitting Excel**

If you're new to Excel, launching the program for the first time can be headache-inducing. So many icons! So many lines! So little guidance! The problem is that you've been catapulted into what appears to be a strange and exotic landscape without a map, a guidebook, or even a “You are here” sign. You wouldn't travel to Upper Volta or lower Manhattan without these tools in your travel kit, so why are you visiting Excel that way?

Ah, but your purchase of this book shows that you are, indeed, a savvy and sophisticated traveler. Now you've got the guidebook you need to learn the language, customs, and tourist hotspots of Excel. And the map? That's what this chapter is all about. Here you take a guided tour that points out the main features of the Excel landscape; shows you the best ways to navigate from the spreadsheet equivalent of Point A to Point B; and tells you how to call for help should the need arise.

Oh, and by the way: You are *here*. Let's go!

A Bird's-Eye View of Excel

Excel relies primarily on the onscreen element called the Ribbon, which is how you select the vast majority of Excel commands. In addition, Excel offers a single toolbar (the Quick Access toolbar, which is hidden by default), some context-sensitive buttons and command bars in the form of the Quick Analysis tool and mini-bar, contextual tabs that only appear on the Ribbon when you select certain Excel elements (such as a table or image), along with a number of task panes (such as Clipboard, Research, Thesaurus, and Selection to name a few).

Among the features supported when selecting certain style and formatting commands is the Live Preview, which shows you how your actual worksheet data will appear in a particular font, table formatting, and so on before you actually apply it. Excel also supports an honest-to-goodness Page Layout view that displays rulers and margins along with headers and footers for every worksheet. Page Layout view has a zoom slider at the bottom of the screen that enables you to zoom in and out on the spreadsheet data instantly. The Backstage view attached to the File tab on the Excel Ribbon enables you to get at-a-glance information about your spreadsheet files as well as save, share, preview, and print them. Last but not least, Excel is full of pop-up galleries that make spreadsheet formatting and charting a real breeze, especially with the program's Live Preview.

Before moving on, take a second to understand the difference between two terms that you see over and over in this book:

- **Worksheet:** This is Excel's work area. That is, it's the part of the Excel window where you enter text and data, create formulas, and much more. Note that, in this book, the words *worksheet*, *spreadsheet*, and *sheet* are synonymous.
- **Workbook:** This is an Excel file and it's a collection of one or more worksheets. Each worksheet appears separately in its own tab, as you discover a bit later in the "Surfing the sheets in a workbook" section.

Checking Out Excel's Start Screen

When you first launch Excel, the program welcomes you with an Excel Start screen similar to the one shown in Figure 1-1. This screen is divided into two panes.

The left green navigation pane with the Home icon selected contains New and Open items at the top and Account, Feedback, and Options at the bottom.

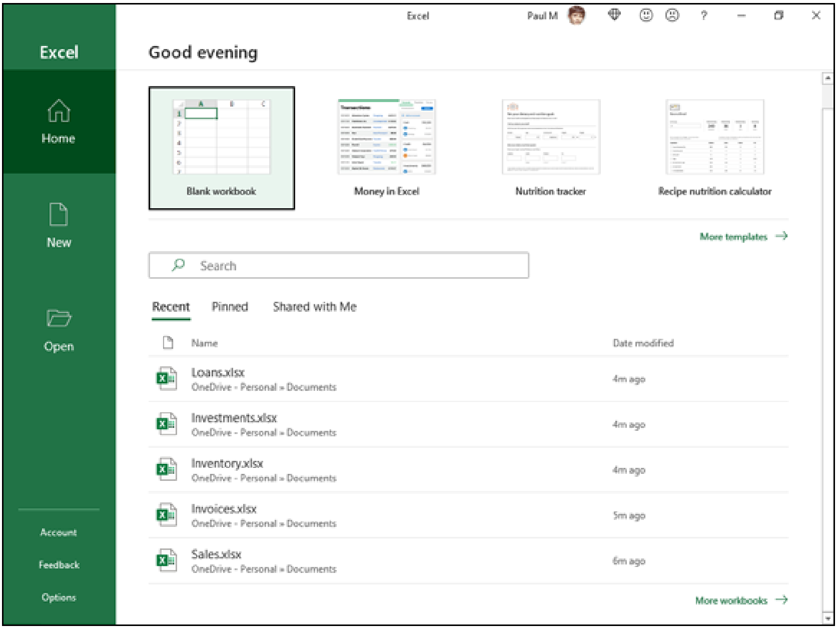

Excel
Paul M
Excel
Good evening
Home
New
Open
Account
Feedback
Options
Blank workbook
Money in Excel
Nutrition tracker
Recipe nutrition calculator
More templates →
Search
Recent
Pinned
Shared with Me
Name
Date modified
Loans.xlsx
OneDrive - Personal » Documents
4m ago
Investments.xlsx
OneDrive - Personal » Documents
4m ago
Inventory.xlsx
OneDrive - Personal » Documents
4m ago
Invoices.xlsx
OneDrive - Personal » Documents
5m ago
Sales.xlsx
OneDrive - Personal » Documents
6m ago
More workbooks →

FIGURE 1-1: The Excel Start screen with the Home tab selected that appears immediately after launching the program.

The right pane displays a single row of thumbnails showing some of the different templates you can use to create a new workbook at the top with a list of some of the most recently opened workbooks shown below. To see more templates to use in creating a new workbook, you can click either the More Templates link on the right side of the Home screen or the New icon in the navigation pane on the left.

If none of the Excel templates shown in the Home screen fit the bill, click More Templates (or click New in the Navigation pane) to open the New screen displaying a whole host of standard templates that you can select to use as the basis for new workbooks. These templates enable you to create a budget, track a project, create an invoice, and more. (See Book 2, Chapter 1 for more on creating new workbooks from ready-made and custom templates.)

To open an existing Excel workbook not displayed in the Recent list, click either the More Workbooks link on the lower-right side of the Home screen or the Open icon in the navigation pane on the left.

The first template thumbnail displayed on the top row of the Home tab on the Start screen is called Blank Workbook, and you select this thumbnail to start a new workbook of your own design.

Getting Comfy with the Excel User Interface

When you first open a new, blank workbook by clicking the Blank Workbook thumbnail in the Home screen, Excel opens a single worksheet (with the generic name, Sheet1) in a new workbook file (with the generic filename, Book1) inside a program window such as the one shown in Figure 1-2.

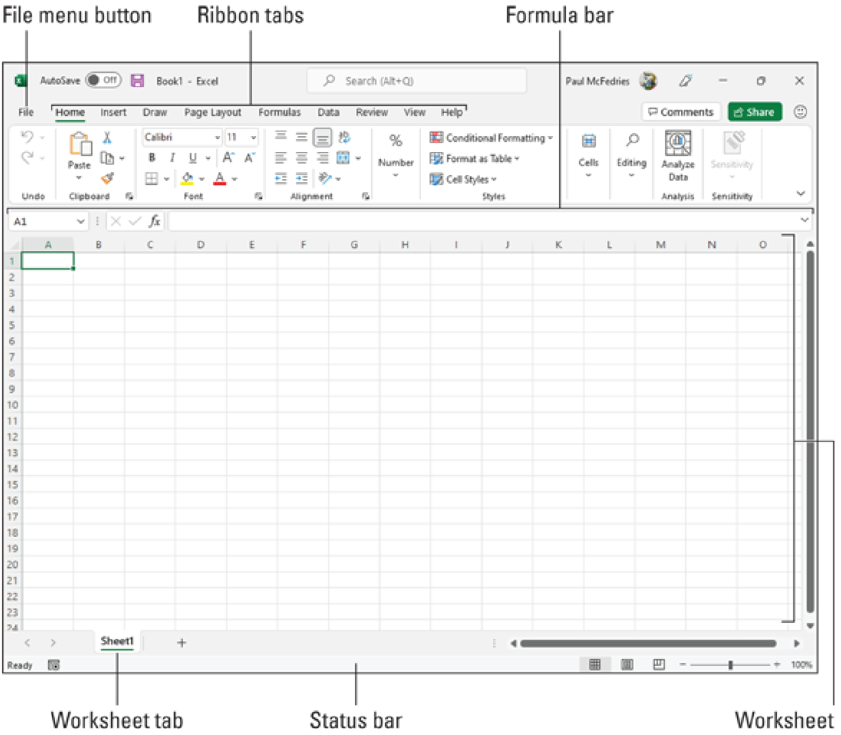

File menu button
Ribbon tabs
Formula bar
AutoSave Off
Book1 - Excel
Search (Alt+Q)
Paul McFedries
File
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Help
Comments
Share
Undo
Paste
Clipboard
Calibri
11
Font
Alignment
Number
Conditional Formatting
Format as Table
Cell Styles
Styles
Cells
Editing
Analyze Data
Analysis
Sensitivity
A1
Sheet1
Ready
100%
Worksheet tab
Status bar
Worksheet

FIGURE 1-2: The Excel program window as it appears after first opening a blank workbook.

The Excel program window is made up of the following components:

- **File menu button:** When clicked, Excel opens the Backstage view, which contains a bunch of file-related commands: Home, New, Open, Save, Save As (or Save a Copy), Print, Share, Export, Publish, Close. You also see Account, which gives you information and tasks related to your Microsoft account; as well as Options, which enables you to change Excel's default settings.

- **Ribbon:** Most Excel commands are contained on the Ribbon. They're arranged into a series of tabs ranging from Home through Help.
- **Formula bar:** This displays the address of the active cell along with the contents of that cell. You can also use it to enter and edit cell data and formulas.
- **Worksheet:** This is your Excel work area, which consists of a series of columns (identified by the letters along the top: A, B, C, and so on) and a series of rows (identified by the numbers running down the left: 1, 2, 3, and so on). The intersection of each column and row is called a *cell* and you enter your Excel data and formulas into these cells. You also see a tab for each worksheet (although the default new workbook comes with just one worksheet). You use a horizontal scroll bar on the bottom to move left and right through the sheet and a vertical scroll bar on the right edge to move up and down through the sheet.
- **Status bar:** This bar keeps you informed of the program's current mode and any special keys you engage, and it enables you to select a new worksheet view and to zoom in and out on the worksheet.

TIP

When using Excel on a touchscreen device, the Ribbon Display Options are automatically set to Show Tabs Only (so that associated commands appear only when you tap a tab). To make it easier to select Ribbon commands with your finger or a stylus, click Ribbon Display Options (pointed out later in Figure 1-4) and then click Touch Spacing. With touch spacing engaged, Excel spreads out the tabs and their command buttons on the Ribbon. That way you have a fighting chance of correctly selecting them with your finger or stylus. On a touchscreen tablet, Excel automatically adds a Draw tab to the Ribbon containing loads of inking options that enable you to modify settings for drawing with your finger, a stylus, or a digital pen.

Going behind the scenes to Excel's Backstage view

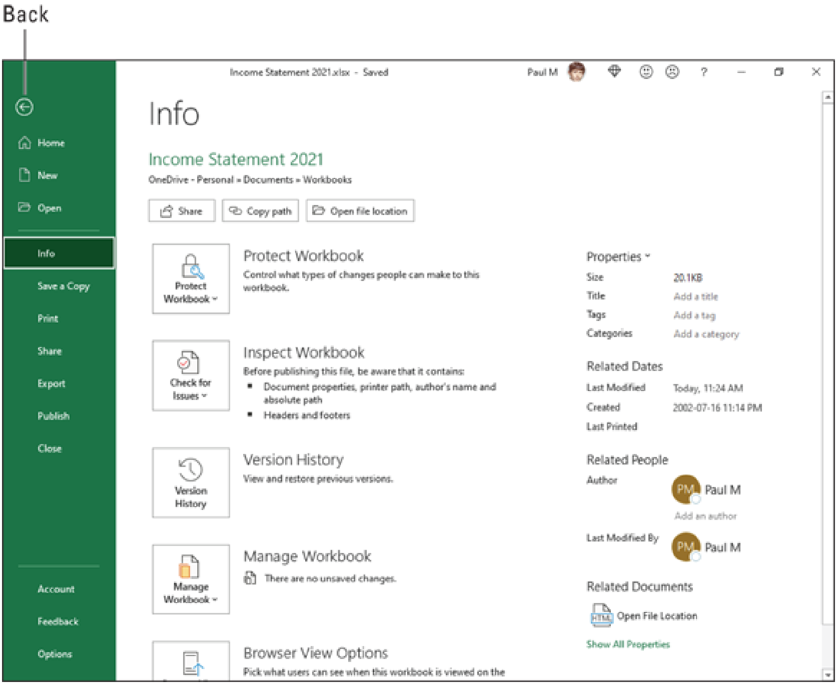
In the upper-left corner of the Excel program window, you find the File menu button, pointed out in Figure 1-2. When you click the File menu button or press Alt + F, the Excel Backstage view appears with the Home command selected. Backstage view contains a menu of file-related commands running down a column on the left side and, depending upon which option is selected, some panels containing both at-a-glance information and further command options.

REMEMBER At first glance, the File menu button may appear to you like a Ribbon tab — especially in light of its location immediately left of the Ribbon’s initial Home tab. However, this important file control is technically a command button that, when clicked, leads directly to a totally different screen: the Backstage view. This screen has its own menu options but contains no Ribbon command buttons whatsoever.

TIP After you click the File menu button to switch to the Backstage view, you can then click the Back button (with the left-pointing arrow; see Figure 1-3) or press the Esc key to return to the normal worksheet view.

Getting the lowdown on the Info screen

When you choose File ⇒ Info to select the Backstage view's Info command, an Info screen similar to the one shown in Figure 1-3 appears.


Back
Income Statement 2021.xlsx - Saved
Paul M
Home
New
Open
Info
Save a Copy
Print
Share
Export
Publish
Close
Account
Feedback
Options
Info
Share
Copy path
Open file location
Protect Workbook
Check for Issues
Version History
Manage Workbook
Properties
Related Dates
Related People
Related Documents
Open File Location
Show All Properties

Income Statement 2021

OneDrive - Personal » Documents » Workbooks

Protect Workbook

Control what types of changes people can make to this workbook.

Inspect Workbook

Before publishing this file, be aware that it contains:

- Document properties, printer path, author's name and absolute path
- Headers and footers

Version History

View and restore previous versions.

Manage Workbook

There are no unsaved changes.

Browser View Options

Pick what users can see when this workbook is viewed on the

Size	20.1KB
Title	Add a title
Tags	Add a tag
Categories	Add a category
Last Modified	Today, 11:24 AM
Created	2002-07-16 11:14 PM
Last Printed	
Author	Paul M Add an author
Last Modified By	Paul M

FIGURE 1-3: The Excel Backstage view displaying the Info screen with permissions, distribution, version commands, and more.

On the left side of this Info screen, you find the following five command buttons:

- **Protect Workbook:** Encrypt the Excel workbook file with a password, protect its contents, or verify the contents of the file with a digital signature (see Book 4, Chapters 1 and 2 for more on protecting and signing your workbooks).
- **Inspect Workbook:** Inspect the document for hidden *metadata* (data about the file) and check the file's accessibility for folks with disabilities and compatibility with earlier versions of Excel (see Book 4, Chapter 3 for details on using this feature).
- **Version History:** View previous versions of the workbook and restore an older version.
- **Manage Workbook:** Recover or delete draft versions saved with Excel's AutoRecover feature. (See Book 2, Chapter 1 for more on using AutoRecover.)
- **Browser View Options:** Control what parts of the Excel workbook

can be viewed and edited by users who view it online.

On the right side of the Info screen, you see a list of various and sundry bits of information about the file. although most of these bits don't get filled in until you save the workbook (see Book 2, Chapter 1). Here's a summary:

- **Properties** lists the Size of the file as well as any Title, Tags, and Categories (to help identify the file when doing a search for the workbook) assigned to it. To edit or add to the Title, Tags, or Categories properties, click the appropriate text box and begin typing. To add or change additional file properties, including the Company, Comments, and Status properties, click the Properties drop-down button and then click Advanced Properties from its drop-down menu. Excel opens the workbook's Properties dialog box (with its General, Summary, Statistics, Contents, and Custom tabs) to change and review a ton of file properties. If the workbook file is new and you've never saved it on disk, the words "Not Saved Yet" appear after Size.
- **Related Dates** lists the date the file was Last Modified, Created, and Last Printed.
- **Related People** lists the name of the workbook's author as well as the name of the person who last modified the file. To add an author to the workbook file, click the Add an Author link that appears beneath the name of the current author.
- **The Show All Properties link,** when clicked, expands the list of Properties to include text fields for Comments, Template, Status, Categories, Subject, Hyperlink Base, Company, and Manager that you can edit.

Sizing up other File menu commands

Above the Info command at the very top of the File menu, you find the commands you commonly need for working with Excel workbook files, such as creating new workbook files as well as opening an existing workbook for editing. The New command displays a thumbnail list of all the available worksheet templates you can use to create a workbook. (See Book 2, Chapter 1 for more on creating and using workbook templates.)

Immediately below the Info command, you find a Save and Save As (or Save a Copy) commands. You generally use the Save command to manually save the changes you make to a workbook. You generally use the Save As (or, Save a Copy, if your workbook is on OneDrive) command to saves changes in your workbook with a new filename and/or in a new location on your computer or in the cloud (See Book 2, Chapter 1 for more on saving and closing files and Book 2, Chapter 3 for more on opening them.)

Beneath the Save As (or Save a Copy) command you find the Print option that, when selected, displays a Print screen. This screen contains the document’s current print settings (that you can modify) on the left side and a preview area that shows you the pages of the printed worksheet report. (See Book 2, Chapter 5 for more on printing worksheets using the Print Settings panel in the Backstage view.)

Below the Print command you find the Share option, which displays a list of commands for sharing your workbook files online. Beneath this, you find an Export option used to open the Export screen, where you find options for converting your workbooks to other file types, such as PDF or XPS. (See Book 4, Chapter 3 for more about sharing workbook files online as well as converting them to other file formats.)

The Publish option enables you to save your Excel workbooks to a folder on your OneDrive for Business account and then publish it to Microsoft’s Power BI (Business Intelligence) stand-alone application that enables you to create visual dashboards that highlight and help explain the story behind the worksheet data.

Checking user and product information on the Account screen

At the top of the section below the Close command that's used to close a workbook file (hopefully, after saving all your edits) on the File menu, you find the Account command. You can use this option to review account-related information on the Backstage view's Account screen. When displayed, the Account screen gives you both user and product information.

On the left side of the Account screen, your user information appears, including all the online services to which you’re currently connected. These services include social media sites such as Facebook, Twitter, and LinkedIn, as well as the more corporate services such as your OneDrive, SharePoint team site, and Microsoft 365 account.

To add an online service to this list, click the Add a Service button at the bottom and select the service to add on the Images & Videos, Storage, and Sharing continuation menus. To manage which accounts appear on the list, highlight the name and click the Remove button to take it off the list. To manage the settings for a particular service, click the Manage button and then edit the settings online.

TIP

Use the Office Background drop-down list box that appears between your user information and the Connected Services list on the Account screen to change the pattern that appears in the background of the title bar of all your Office programs. By default, Office uses no background. You can change the background by clicking a new pattern from the Office Background drop-down menu on the Account screen (and you can always switch back to have no pattern displayed by clicking No Background from the menu). Below this option, you see the Office Theme selection (Colorful by default) that sets the overall color pattern you use. Just be aware that any change you make here affects the title areas of all the Office programs you run on your device (not just the Excel program window).

On the right side of the Account screen, you find the Subscription Product information. Here you can see the type of Microsoft 365 installation as well as review the version number of Excel that is installed on your device. Because many Microsoft 365 licenses allow up to five installations of Office on different devices (desktop computer, laptop, Windows tablet, and smartphone, for example), you can click the Manage Account link to go online. There, you can check how many Office installations you still have available and, if need be, manage the devices on which Office is activated. If you need more installations for your company, you can use the Change License button to upgrade to another subscription plan that better fits your needs.

Ripping through the Ribbon

The Ribbon (shown in Figure 1-4) groups related commands together with the goal of showing you all the most commonly used options needed to perform a particular Excel task.

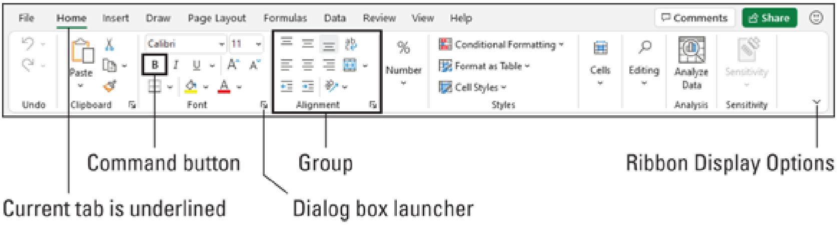

File
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Help
Comments
Share
Undo
Paste
Clipboard
Calibri
11
Font
Alignment
Number
Conditional Formatting
Format as Table
Cell Styles
Styles
Cells
Editing
Analyze Data
Analysis
Sensitivity
Command button
Group
Ribbon Display Options
Current tab is underlined
Dialog box launcher

FIGURE 1-4: Excel's Ribbon consists of a series of tabs containing command buttons arranged

into different groups.

The Ribbon is made up of the following components:

- **Tabs:** Represent Excel’s main tasks. Each tab displays all the commands commonly needed to perform that core task. (No, “Home” isn't a task! Think of the Home tab as your go-to place for the most common Excel commands.)
- **Groups:** Related command buttons that appear together, separated by vertical lines. Think of each group as a collection of commands related to some subtask of the tab’s larger core task. On the Home tab, for example, the first few groups are Undo, Clipboard, Font, and Alignment.
- **Command buttons:** Group items that you click to perform a particular action or to open a list or gallery. Note that many command buttons on certain tabs of the Excel Ribbon are organized into mini-toolbars with related settings.
- **Dialog box launcher:** A button that opens a dialog box containing a bunch of additional commands and settings related to the group where the dialog box is located. Not all groups come with a dialog box launcher.

To get more of the Worksheet area displayed in the program window, you can minimize the Ribbon so that only its tabs are displayed. (In fact, this Show Tabs Only display option is the default setting for Excel running on a touchscreen device.)

When the Ribbon is pinned to the Excel program screen, you can minimize it by doing any of the following:

- **Click** the Ribbon Display Options button (pointed out in Figure 1-4) and then click Show Tabs Only.
- **Double-click** a Ribbon tab.
- **Press** Ctrl+F1.
- **Right-click** a Ribbon tab and then click Collapse the Ribbon.

TIP To redisplay the entire Ribbon and keep all the command buttons on the selected tab displayed in the program window, click the tab and then choose Ribbon Display Options ⇒ Always Show Ribbon. You can also do this by double-clicking one of the tabs or pressing Ctrl+F1 a second time.

When you work in Excel with the Ribbon minimized, the Ribbon expands each time you click one of its tabs to show its command buttons, but that tab stays open only until you click one of its command buttons. The moment you click a command button, Excel immediately minimizes the Ribbon again so that only the tabs display.

Note, however, that when Excel expands a tab on the collapsed Ribbon, the Ribbon tab overlaps the top of the worksheet, obscuring the header with the column letters as well as the first couple of rows of the worksheet itself. This setup can make it a little harder to work when the Ribbon commands you're selecting pertain to data in these first rows of the worksheet.

Keeping tabs on the Excel Ribbon

The very first time you launch Excel and open a new workbook, the Ribbon contains the following eight tabs, proceeding from left to right:

- **Home:** Use this tab when creating, formatting, and editing a worksheet. This tab is arranged into the Clipboard, Font, Alignment, Number, Styles, Cells, Editing, and Analysis groups.

- **Insert:** Use this tab when adding particular elements (including graphics, PivotTables, charts, hyperlinks, and headers and footers) to a worksheet. This tab is arranged into the Tables, Illustrations, Add-ins, Charts, Tours, Sparklines, Filters, Links, Comments, Text, and Symbols groups.

- **Page Layout:** Use this tab when preparing a worksheet for printing or reordering graphics on the sheet. This tab is arranged into the Themes, Page Setup, Scale to Fit, Sheet Options, and Arrange groups.

- **Formulas:** Use this tab when adding formulas and functions to a worksheet or checking a worksheet for formula errors. This tab is arranged into the Function Library, Defined Names, Formula Auditing, and Calculation groups. Note that this tab also contains a Solutions group when you activate certain add-in programs, such as Conditional Sum and Euro Currency Tools — see Book 1, Chapter 2 for more on Excel Add-ins.

- **Data:** Use this tab when importing, querying, outlining, and subtotaling the data placed into a worksheet's data list. This tab is arranged into the Get & Transform Data, Queries & Connections, Data Types, Sort & Filter, Data Tools, Forecast, and Outline groups. Note that this tab also contains an Analyze group if you activate add-ins, such as the Analysis ToolPak and Solver Add-In — see Book 1, Chapter 2 for more on Excel Add-ins.

- **Review:** Use this tab when proofing, protecting, and marking up a worksheet for review by others. This tab is arranged into the Proofing, Accessibility, Insights, Language, Comments, Notes, and Protect groups. Note that this tab also contains an Ink group with a sole Hide Ink button if you're running Excel on a Windows tablet or smartphone or on a laptop or desktop computer that's equipped with some sort of electronic input tablet.
- **View:** Use this tab when changing the display of the Worksheet area and the data it contains. This tab is arranged into the Sheet View, Workbook Views, Show, Zoom, Window, and Macros groups.
- **Help:** Use this tab to get online help and training on using Excel as well as give feedback on the program. (See "Getting Help" later in this chapter for details.)

Note that if you're using Excel on a touchscreen device, you also have a Draw tab on your Ribbon that enables you to modify inking options when using a drawing device such as Surface Pen.

Although these tabs are the standard ones on the Ribbon, they're not the only tabs that can appear in this area. Excel displays one or more contextual tabs as long as you're working on a particular object selected in the worksheet, such as a graphic image you've added or a chart or PivotTable you've created.

The moment you deselect the object (usually by clicking somewhere on the sheet outside of its boundaries), the object's contextual tabs immediately disappear from the Ribbon, leaving only the regular tabs displayed.

Adding the Developer tab to the Ribbon

If you do a lot of work with macros (see Book 8, Chapter 1) and XML files in Excel, you should add the Developer tab to the Ribbon. This tab contains all the command buttons normally needed to create, run, and edit macros as well as to import and map XML files. To add the Developer tab to the Excel Ribbon, follow these steps:

1. **Choose File ⇒ Options to open the Excel Options dialog box, then click Customize Ribbon.**

Alternatively, you can press Alt+FTC or right-click one of the Ribbon tabs and then select Customize the Ribbon.

The Customize the Ribbon options appear.

2. **Select the Developer check box under Main Tabs in the Customize the Ribbon list box on the right.**
3. **Click OK to finish.**

   Excel now displays the Developer tab in the Ribbon.

Selecting with mouse and keyboard

Because Excel runs on many different types of devices, the most efficient means of selecting Ribbon commands depends not only on the device on which you’re running the program, but on the way that device is equipped as well.

For example, when I use Excel on my touchscreen notebook computer with the keyboard and touchpad connected, I select commands from the Excel Ribbon the same way I do when running Excel on my Windows desktop computer equipped with a standalone physical keyboard and mouse or on my Windows laptop computer with its built-in physical keyboard and trackpad.

However, when I run Excel on my touchscreen device in tablet mode when the touchscreen is disconnected from the keyboard, I’m limited to selecting Ribbon commands directly on the touchscreen with my finger or digital pen.

When you're rocking Excel with a mouse and keyboard, the most common method for selecting Ribbon commands is to click the tab that contains the command button you want and then click that button in its group. For example, to insert an online image into your worksheet, you click the Insert tab and then click the Online Pictures button to open the Online Pictures dialog box.

An alternative method for selecting commands on the Ribbon — useful if you're not that dexterous with your mouse — is to press the keyboard’s Alt key and then press the letter of the KeyTip that appears on the tab you want to select. Excel then displays all the command button KeysTips next to their buttons, along with the KeyTips for the Dialog Box launchers in any group on that tab. (See Figure 1-5.) To select a command button or Dialog Box launcher, press its KeyTip letter.

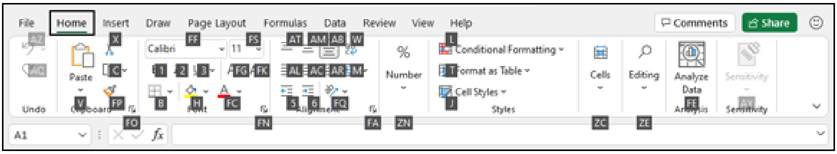

File
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Help
Comments
Share
Undo
Paste
Clipboard
Calibri
11
Font
Alignment
Number
Conditional Formatting
Format as Table
Cell Styles
Styles
Cells
Editing
Analyze Data
Analysis
Sensitivity
A1

FIGURE 1-5: When you select a Ribbon tab by pressing Alt and the KeyTip letter assigned to that tab, Excel displays the KeyTips for its command buttons.

TIP

If you know the old Excel shortcut keys from versions prior to Excel 2007, you can still use them. For example, instead of going through the rigmarole of pressing Alt+HCC to copy a cell selection to the Windows Clipboard and then Alt+HVP to paste it elsewhere in the sheet, you can still press Ctrl+C to copy the selection and then press Ctrl+V when you're ready to paste it.

Selecting Ribbon commands by touch

When selecting Ribbon commands on a touchscreen device without access to a physical keyboard and mouse or touchpad, you're limited to selecting commands directly by touch.

WHAT "CLICK AND DRAG" MEANS ON YOUR DEVICE

Given all the different choices for selecting stuff in Excel, you need to be aware of a few click-and-drag conventions used throughout this book:

- **When I say, "click**", this means press and release the primary mouse button (the left one unless you change it) on a physical mouse or tap the object directly with your finger or stylus.
- **When I say, "double-click,"** this means press and release the primary button twice in rapid succession on a physical mouse or double-tap the object with your finger or stylus.
- **When I say, "right-click,"** this means click the secondary button (the right button unless you change it) on a physical mouse or tap the item and keep your finger or stylus on the touchscreen until the context menu, pop-up gallery, or whatever appears. When using a

digital pen, you need to click the button on the side of the pen as you tap the item.

- **When I say, "drag through a cell selection,"** with a physical mouse this means click the first cell and hold down the primary mouse button as you move the mouse pointer through the cells, and then release the button when the selection is complete. On a touchscreen, you tap the first cell and then drag one of the selection handles (the circle that appears in the upper-left or lower-right corner of the selected cell) to make the selection.

Before trying to select Ribbon commands by touch, however, you definitely want to turn on touch spacing in Excel. You can do this by choosing Ribbon Display Options ⇒ Touch Spacing. With touch spacing engaged, Excel spreads out the command buttons on the Ribbon tabs by putting more space around them, making it more likely that you'll actually select the command button you're tapping with your finger (or even a more slender stylus or pen tip) instead of the one right next to it. (This is a particular problem with the command buttons in the Font group on the Home tab that enable you to add different attributes to cell entries such as bold, italic, or underlining: They're so close together when touch spacing is not on that they're almost impossible to correctly select by touch.)

Working with the Quick Access toolbar

As its name implies, the purpose of the Quick Access toolbar is to give you speedy access to a few Excel tools. That sounds great, so why is the Quick Access toolbar hidden by default in the latest versions of Excel? Good question. The Quick Access toolbar used to appear in the Excel title bar (although you could change that position), so perhaps Microsoft figured the title bar was getting a tad overcrowded. Microsoft did keep the AutoSave switch and the Save button in the title bar, but these are no longer part of the Quick Access toolbar. (Also, Microsoft moved the Undo and Redo buttons to the Home tab.)

If you want to use the Quick Access toolbar, your first chore is to display it. To get the Quick Access toolbar onscreen, use any one of the following methods:

- Right-click any part of the Ribbon and then click Show Quick Access Toolbar.
- Choose Ribbon Display Options ⇒ Show Quick Access Toolbar.
- Choose File ⇒ Options (or press Alt + FT) to open the Excel Options dialog box, click Quick Access Toolbar, select the Show Quick

Access Toolbar check box, and then click OK.

The Quick Access toolbar is very customizable because you can easily add any Ribbon command to it. Moreover, you’re not restricted to adding buttons for just the commands on the Ribbon; you can add any Excel command you want to the toolbar, even the obscure ones that don’t rate an appearance on any of its tabs. (See Book 1, Chapter 2 for details on customizing the Quick Access toolbar.)

By default, the Quick Access toolbar appears below the Ribbon tabs. To display the toolbar above the Ribbon, click the Customize Quick Access Toolbar button (the drop-down button to the direct right of the toolbar with a horizontal bar above a down-pointing triangle) and then select Show Above the Ribbon from its drop-down menu. Doing this give you a bit more vertical worksheet real estate, but at the cost of minimizing the Search box to an icon and having less overall room to add Quick Access toolbar buttons.

Fooling around with the Formula bar

The Formula bar displays the cell address and the contents of the active cell. The address of this cell is determined by its column letter(s) followed immediately by its row number, as in cell A1, the very first cell of each worksheet at the intersection of column A and row 1, or cell XFD1048576, the very last cell of each Excel worksheet at the intersection of column XFD and row 1048576. The contents of the active cell are determined by the type of entry you make there: text or numbers, if you just enter a heading or value, and the nuts and bolts of a formula, if you enter a calculation there.

The Formula bar is divided into three sections:

- **Name box:** The leftmost section displays the address of the active cell or the cell's defined range name, if it has one. (See Book 2, Chapter 2 to find out how to define range names.)
- **Formula bar buttons:** The second, middle section usually has only the Insert Function button (labeled *fx*) enabled. When you start making or editing a cell entry, the Cancel (an *X*) and Enter (a check mark) buttons are also enabled.
- **Cell contents:** The third white area to the immediate right of the Insert Function button takes up the rest of the bar and expands as necessary to display really, really long cell entries that won’t fit in the normal area. This area contains a Formula Bar button on the far right that enables you to expand its display to show really long formulas that span more than a single row and then to contract the

Cell contents area back to its normal single row.

The Cell contents section of the Formula bar is important because it *always* shows you the contents of the cell even when the worksheet does not. (When you're dealing with a formula, Excel displays only the formula result in the cell and not the formula itself.) You can edit the contents of the cell in this area at any time. By the same token, when the Cell contents area is blank, you know that the cell is empty as well.

ASSIGNING 26 LETTERS TO 16,384 COLUMNS

When it comes to labeling the 16,384 columns of an Excel worksheet, our alphabet with its measly 26 letters is simply not up to the task. To make up the difference, Excel first doubles the letters in the cell's column reference so that column AA follows column Z (after which you find column AB, AC, and so on) and then triples them so that column AAA follows column ZZ (after which you get column AAB, AAC, and the like). At the end of this letter tripling, the 16,384th and last column of the worksheet ends up being XFD, so that the last cell in the 1,048,576th row has the cell address XFD1048576.

What's up with the Worksheet area?

The Worksheet area is where most of the Excel spreadsheet action takes place because it displays the cells of the current worksheet. Also, inside the cells is where you do all of your spreadsheet data entry and formatting, not to mention the majority of your editing. (Yes, that's right: You can enter or edit cell data using either the formula bar or the cell directly. Most people prefer the latter.)

Keep in mind that to enter or edit data in a cell, that cell must be the active cell. Excel indicates the active cell in three ways:

- The cell pointer — the dark green border surrounding the cell's entire perimeter — appears in the cell.
- The address of the cell appears in the Name box of the Formula bar.
- The cell's column letter(s) and row number are shaded (in an green color on most monitors) in the column headings and row headings that appear at the top and left of the Worksheet area, respectively.

Moving around the worksheet

Excel offers many methods for moving the cell pointer around the worksheet to the cell where you want to enter new data or edit existing data:

- Click the desired cell — assuming that the cell is displayed within the section of the sheet currently visible in the Worksheet area.
- Click the Name box, type the address of the desired cell directly into this box, and then press Enter.
- Press F5, Ctrl + G, or Alt + HFDG to open the Go To dialog box, type the address of the desired cell into its Reference text box, and then click OK.
- Use the cursor keys, as shown in Table 1-1, to move the cell pointer to the desired cell.
- Use the horizontal and vertical scroll bars at the bottom and right edges of the Worksheet area to move the part of the worksheet that contains the desired cell. Then click the cell to put the cell pointer in it.

TABLE 1-1 Keystrokes for Moving the Cell Pointer

Keystroke	***Where the Cell Pointer Moves***
→ or Tab	Cell to the immediate right.
← or Shift+Tab	Cell to the immediate left.
↑	Cell up one row.
↓	Cell down one row.
Home	Cell in column A of the current row.
Ctrl+Home	First cell (A1) of the worksheet.
Ctrl+End or End, Home	Cell in the worksheet at the intersection of the last column that has any data in it and the last row that has any data in it. (That is, the last cell of the so-called active area of the worksheet.)
PgUp	Cell one screenful up in the same column.
PgDn	Cell one screenful down in the same column.
Ctrl+→ or End, →	First occupied cell to the right in the same row that is either preceded or followed by a blank cell. If no cell is occupied, the pointer goes to the cell at the very end of the row.
Ctrl+← or End, ←	First occupied cell to the left in the same row that is either preceded or followed by a blank cell. If no cell is occupied, the pointer goes to the cell at the very beginning of the row.
Ctrl+↑ or End, ↑	First occupied cell above in the same column that is either preceded or followed by a blank cell. If no cell is occupied, the pointer goes to the cell at the very top of the column.
Ctrl+↓ or End, ↓	First occupied cell below in the same column that is either preceded or followed by a blank cell. If no cell is occupied, the pointer goes to the cell at the very bottom of the column.
Ctrl+Page Down	Last occupied cell in the next worksheet of that workbook.
Ctrl+Page Up	Last occupied cell in the previous worksheet of that workbook.

Note: *In the case of those keystrokes that use arrow keys, you must either use the arrows on the* *cursor keypad or have the Num Lock key disengaged on the numeric keypad of your keyboard.*

Keystroke shortcuts for moving the cell pointer

Excel offers a wide variety of keystrokes for moving the cell pointer to a new cell. When you use one of these keystrokes, the program automatically scrolls a new part of the worksheet into view, if this is required to move the cell pointer. In Table 1-1, I summarize these keystrokes and how far each one moves the cell pointer from its starting position.

The keystrokes that combine the Ctrl or End key with an arrow key (listed in Table 1-1) are among the most helpful for moving quickly from one edge to the other in large tables of cell entries. Moving from table to table in a section of the worksheet that contains many blocks of cells is also much easier.

When you use Ctrl and an arrow key to move from edge to edge in a table or between tables in a worksheet on a physical keyboard, you hold down Ctrl while you press one of the four arrow keys (indicated by the + symbol in keystrokes, such as Ctrl+→). On the Touch keyboard, you tap Ctrl and then tap the appropriate arrow key to accomplish the same thing.

When you use End and an arrow-key alternative, you must press and then release the End key *before* you press the arrow key (indicated by the comma in keystrokes, such as End, →). Pressing and releasing the End key causes the END MODE indicator to appear onscreen in the Status bar. This is your sign that Excel is ready for you to press one of the four arrow keys.

Because you can keep the Ctrl key depressed as you press the different arrow keys that you need to use, the Ctrl-plus-arrow key method provides a more fluid method for navigating blocks of cells on a physical keyboard than the End-then-arrow key method. On the Touch keyboard, there is essentially no difference in technique.

You can use the Scroll Lock key to “freeze” the position of the cell pointer in the worksheet so that you can scroll new areas of the worksheet in view with keystrokes such as PgUp (Page Up) and PgDn (Page Down) without changing the cell pointer’s original position (in essence, making these keystrokes work in the same manner as the scroll bars).

After engaging Scroll Lock (often abbreviated ScrLk), when you scroll the worksheet with the keyboard, Excel doesn’t select a new cell while it brings a new section of the worksheet into view. To “unfreeze” the cell pointer when scrolling the worksheet via the keyboard, you just press the Scroll Lock key again.

Tips on using the scroll bars

To understand how scrolling works in Excel, imagine the worksheet is a humongous papyrus scroll attached to rollers on the left and right. To bring into view a new section of a papyrus worksheet that is hidden on the right, you crank the left roller until the section with the cells that you want to see appears. Likewise, to scroll into view a new section of the worksheet that is hidden on the left, you crank the right roller until that section of cells appears.

You can use the horizontal scroll bar at the bottom of the Worksheet area to scroll back and forth through the columns of a worksheet. Likewise, you can use the vertical scroll bar to scroll up and down through its rows. To scroll one column or a row at a time in a particular direction, click the appropriate scroll arrow at the ends of the scroll bar. To jump immediately back to the originally displayed area of the worksheet after scrolling through single columns or rows in this fashion, click the darker area in the scroll bar that now appears in front of or after the scroll button within the scroll bar.

You can resize the horizontal scroll bar, making it wider or narrower, by dragging the button that appears to the immediate left of its left scroll arrow. When working in a workbook that contains a whole bunch of worksheets, in widening the horizontal scroll bar you can end up hiding the display of the workbook’s later sheet tabs.

To scroll very quickly through columns or rows of the worksheet, hold down the Shift key and then drag the mouse pointer in the appropriate direction within the scroll bar until the columns or rows that you want to see appear on the screen in the Worksheet area. When you hold down the Shift key as you scroll, the scroll button within the scroll bar becomes really narrow, and a ScreenTip appears next to the scroll bar, keeping you informed of the letter(s) of the columns or the numbers of the rows that you’re currently whizzing through.

If your mouse has a wheel, you can use it to scroll directly through the columns and rows of the worksheet without using the horizontal or vertical scroll bars. Position the white-cross mouse pointer in the center of the Worksheet area and then hold down the wheel button of the mouse. When the mouse pointer changes to a four-point arrow, drag the mouse pointer in the appropriate direction (left and right to scroll through columns or up and down to scroll through rows) until the desired column or row comes into view in the Worksheet area.

TIP On a touchscreen, you can scroll the worksheet by swiping the screen with your finger. (Don't use your stylus because pressing it in the worksheet area only results in selecting the cell you touch.) You swipe upward to scroll worksheet rows down and swipe down to scroll the rows up. Likewise, you swipe left to scroll columns right and swipe right to scroll columns left.

REMEMBER The only disadvantage to using the scroll bars to move around is that the scroll bars bring only new sections of the worksheet into view — they don't actually change the position of the cell pointer. If you want to start making entries in the cells in a new area of the worksheet, you still have to remember to select the cell (by clicking it) or the group of cells (by dragging through them) where you want the data to appear before you begin entering the data.

ONE GOOD REASON FOR ADDING EXTRA SHEETS TO A WORKBOOK

You may wonder why on earth anyone would ever need more than one worksheet, given just how many cells each sheet contains. The simple truth is that it's all about how you choose to structure a particular workbook rather than running out of places to put the data. For example, say you need to create a workbook that contains budgets for all the various departments in your corporation; you may decide to devote an individual worksheet to each department (with the actual budget worksheet tables laid out in the same manner on each sheet) rather than placing all the tables in different sections of the same sheet. Using this kind of one-sheet-per-budget layout makes it much easier for you to find each budget, print each one as a separate page of a report, and, if ever necessary, consolidate their data in a separate summary worksheet.

Surfing the sheets in a workbook

Each new workbook you open in Excel contains a single blank worksheet, aptly named Sheet1, with 16,384 columns and 1,048,576 rows (giving you a truly staggering total of 17,179,869,184 blank cells!). Should you still need more worksheets in your workbook, you can add them by clicking the New Sheet button (the circle with the plus sign in it) that appears to the immediate right of Sheet1 tab.

On the left side of the bottom of the Worksheet area, the Sheet tab scroll buttons appear, followed by the actual tabs for the worksheets in your workbook and the New Sheet button. To activate a worksheet for editing, you select it by clicking its sheet tab. Excel lets you know what sheet is active by displaying the sheet name on its tab in green, boldface type as well as underlining the tab and making the tab appear to be connected to the current worksheet above.

REMEMBER Don’t forget the Ctrl+Page Down and Ctrl+Page Up shortcut keys for selecting the next and previous sheets, respectively, in your workbook. When the tab bar is full, you can also click the following buttons:

- **Next Sheet:** The ellipsis (…) button on the right side of the sheet tabs immediately left of the New Sheet button. Clicking this button selects the first non-visible tab to the right.
- **Previous Sheet:** The ellipsis (…) button on the left side of the sheet tabs to the immediate left of the first visible sheet tab. Clicking this button selects the first non-visible tab to the left.

If your workbook contains too many sheets for all their tabs to be displayed at the bottom of the Worksheet area, use the Sheet tab scroll buttons to bring new tabs into view (so that you can then click them to activate them). You click the Next Scroll button (the one with the triangle pointing right) to scroll the next hidden sheet tab into view on the right and the Previous Scroll button (the one with the triangle pointing left) to scroll the next hidden sheet into view on the left. You Ctrl+click the Next Scroll button to scroll the last sheet into view and Ctrl+click the Previous Scroll button to scroll the first sheet into view.

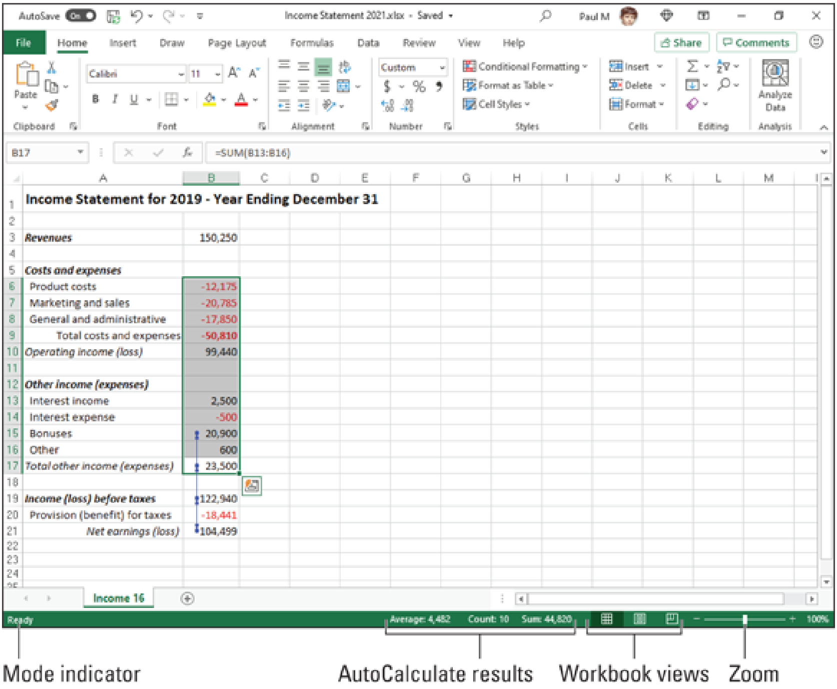
TIP Right-click either Sheet tab scroll button to display the Activate dialog box listing the names of all the worksheets in the workbook in their order from first to last. Then, to scroll to and select a worksheet, double-click its name or click the name followed by OK.

Taking a tour of the Status bar

The Status bar is the last component at the very bottom of the Excel program window. (See Figure 1-6.) The Status bar contains the following items:

- **Mode indicator:** Indicates the current state of the Excel program (READY, ENTER, EDIT, and so on).
- **AutoCalculate results:** Displays the AVERAGE, COUNT, and SUM of all the numerical entries in the active cell selection.
- **Workbook views:** Enables you to select between three views for the Worksheet area: Normal, the default view that shows only the worksheet cells with the column and row headings; Page Layout view, which adds rulers and page margins and shows page breaks for the worksheet; and Page Break Preview, which enables you to adjust the paging of a report.
- **Zoom:** Enables you to zoom in and out on the cells in the Worksheet area by dragging the slider to the right or left, respectively.

You can customize the Status bar by right-clicking it and then activating or deactivating the commands in the shortcut menu that appears.


AutoSave On
Income Statement 2021.xlsx - Saved
Paul M
File
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Help
Share
Comments
Paste
Calibri
11
Custom
Conditional Formatting
Format as Table
Cell Styles
Insert
Delete
Format
Analyze Data
Clipboard
Font
Alignment
Number
Styles
Cells
Editing
Analysis
Income 16
Ready
Average: 4,482
Count: 10
Sum: 44,820
100%
Mode indicator
AutoCalculate results
Workbook views
Zoom

B17 =SUM(B13:B16)

	A	B
1	**Income Statement for 2019 - Year Ending December 31**	
2		
3	***Revenues***	150,250
4		
5	***Costs and expenses***	
6	Product costs	-12,175
7	Marketing and sales	-20,785
8	General and administrative	-17,850
9	Total costs and expenses	-50,810
10	*Operating income (loss)*	99,440
11		
12	***Other income (expenses)***	
13	Interest income	2,500
14	Interest expense	-500
15	Bonuses	20,900
16	Other	600
17	*Total other income (expenses)*	23,500
18		
19	***Income (loss) before taxes***	122,940
20	Provision (benefit) for taxes	-18,441
21	*Net earnings (loss)*	104,499

FIGURE 1-6: The Excel Status bar.

Getting Help

In Excel, help is always available to you in two forms:

- A Search feature that not only shows you the command sequence for the help topic you enter but at times actually initiates and completes the command sequence for you
- Online Help that contains various help topics that explain Excel's many features

Show-and-tell help with the Search feature

Excel's Search feature must be from Missouri because it doesn't just tell you what to do; it actually shows you by performing the task for you. This handy little feature is available from the Search text box located at the top of the Excel window, to the right of the filename. As you enter a help topic into this text box, Excel displays a list of related Excel commands in a drop-down list.

When you then select one of the items displayed on this list, Excel either selects the associated Ribbon command (no matter which Ribbon tab is currently selected) and waits for you to make a selection from the command's submenu or, in some case, just goes ahead and completes the associated command sequence for you.

For example, if you type *print* into the Search text box, Excel displays a list with the following items:

- Print
- Print Preview and Print
- Set Print Area
- Preview and Print with a continuation menu that contains Print Preview and Print, Quick Print, and Print Preview Full Screen options
- Get Help on "Print"

If you select Quick Print on the Preview and Print continuation menu or Print item, Excel immediately sends the current worksheet to the printer. If, however, you select Preview and Print on the continuation menu or on the drop-down list, Excel displays a preview of the printout on the Print Screen in the Backstage view that you can print. If you select the Quick Print item, the program sends the worksheet directly to the printer. But if you select the Print Preview Full Screen item, Excel replaces the Worksheet view with a full screen print preview page from which you can print the worksheet. (See Book 2, Chapter 5 for complete details on previewing and printing your worksheets.)

REMEMBER If you would rather learn how to complete a task in Excel rather than have the program do it for you, select the Get Help on "xyz" item at the end of the list below the Search text box. This opens an Excel Help window with loads of information about using the commands to accomplish that task (as described in the very next section).

Getting Help from the Help tab on the Ribbon

Excel offers extensive online help in the Help taskbar that you can make use of anytime while using the program. To display the Excel

Help taskbar, click the Help button on the Help tab of the Ribbon (Alt +Y2H) or press F1. A Help task pane similar to the one shown in Figure 1-7 appears.

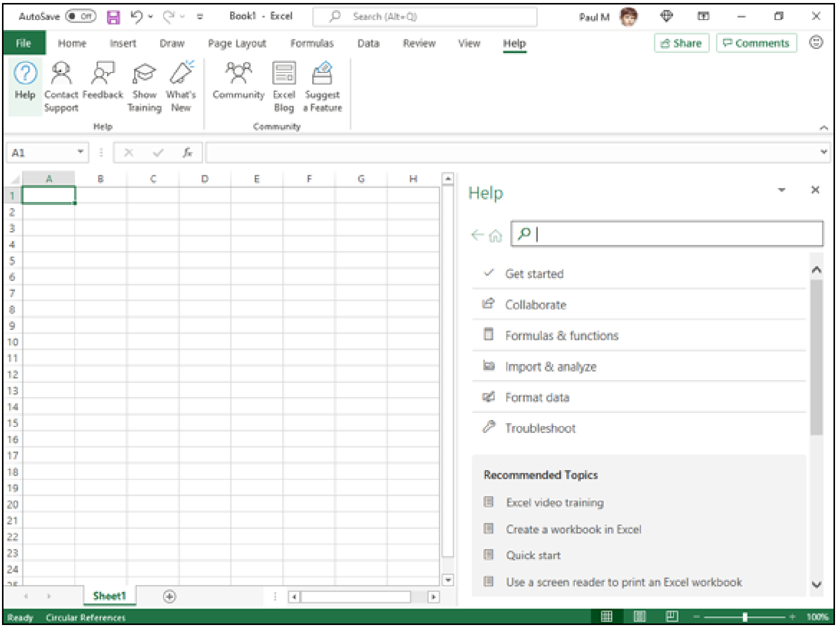

AutoSave Off
Book1 - Excel
Search (Alt+Q)
Paul M
File
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Help
Share
Comments
Help
Contact Support
Feedback
Show Training
What's New
Community
Excel Blog
Suggest a Feature
Help
Community
A1
Help
Get started
Collaborate
Formulas & functions
Import & analyze
Format data
Troubleshoot
Recommended Topics
Excel video training
Create a workbook in Excel
Quick start
Use a screen reader to print an Excel workbook
Sheet1
Ready
Circular References
100%

FIGURE 1-7: The Excel Help task pane.

TIP On a device without any access to the function keys, you can display the online Excel Help window by tapping the Help button on the Help tab of the Ribbon or by using the Touch keyboard to enter *help* into the Search text box and then tapping the Get Help on “help” option in the drop-down list.

At the very top of the Help task pane, you find a search text box with a Search button to the left (the spyglass icon). To display a list of related help topics in the Help task pane, type a keyword or name of a category (such as printing, formulas, and so on) and then click the Search button or press Enter. The Help task pane then displays a list of help topics for that category. To display detailed information about a particular help topic in this list, click its link.

In addition to the Help button, the Ribbon's Help tab contains these “help”ful command buttons:

- **Contact Support** to open a Help task pane containing a text box where you can enter a description of your problem with Excel before clicking its Get Help button to display articles that may help you resolve your issue as well as a Talk to Agent button that enables you to get an agent’s help with a Live Chat.
- **Feedback** to open the Feedback screen in the File menu’s Backstage view where you can send feedback to Microsoft using the I Like Something, I Don’t Like Something, and the I Have a Suggestion Option.
- **Show Training** to open the Help task pane with video tutorials that you can run to learn about features such as designing workbooks, using tables and charts, and using formulas and functions.
- **What’s New** to open the Help task pane with a list of new features in the version of Excel you’re running.
- **Community** to open the Microsoft Excel Community page in your default browser with discussions on all sorts of Excel topics where you can post your questions and concerns to the entire Excel Online community.
- **Excel Blog** to open the Excel Blog page in your default Web browser where articles about all sorts of Excel applications.
- **Suggest a Feature** to open the Excel Suggestion Box page with your default browser where you can give Microsoft your feedback on Excel as well as suggest new features to be added to future versions.

TIP

When you get familiar enough with Excel features that you rarely, if ever, consult help, you can remove the Help tab from the Ribbon. Open the Excel Options dialog box (File ⇒ Options), click the Customize Ribbon button on the left, and then click the Help check box under Main Tabs on the right to remove its check mark before you click OK. Note that after removing the Help tab from the Ribbon, you can still open the Help task pane and get all the Excel help you need by pressing F1 or typing *help* in the Search text box and then clicking the

Get Help option on its drop-down menu.

Launching and Quitting Excel

This chapter closes by looking at the myriad ways you can start and stop Excel on your device.

Starting Excel from the Windows Start menu

The most straightforward way to launch Excel is via the Windows Start menu. To get started, click the Windows icon on the taskbar or press the Windows key on your keyboard.

Scroll down the alphabetical list of apps installed on your device until you get to the Es, and then click the Excel icon, shown in Figure 1-8.

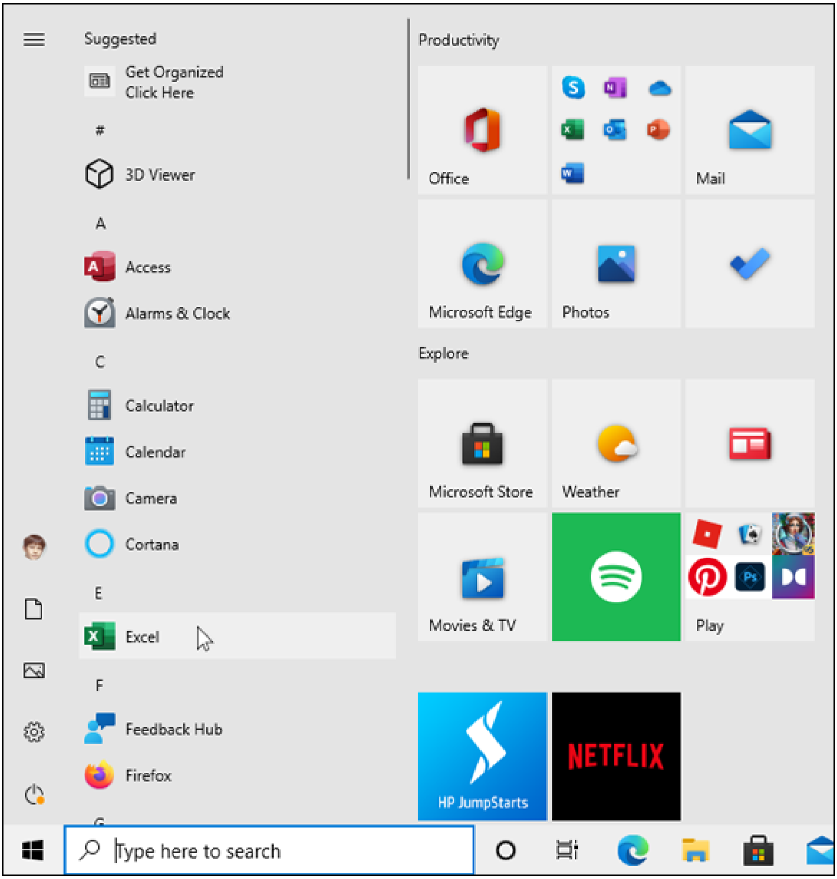

Suggested
Get Organized Click Here
#
3D Viewer
A
Access
Alarms & Clock
C
Calculator
Calendar
Camera
Cortana
E
Excel
F
Feedback Hub
Firefox
Productivity
Office
Mail
Microsoft Edge
Photos
Explore
Microsoft Store
Weather
Movies & TV
Play
HP JumpStarts
NETFLIX
Type here to search

FIGURE 1-8: Launching Excel from the Windows Start screen.

REMEMBER You can pin the Excel program button to the pinned section of the Windows Start menu so that it's always displayed whenever you open the Windows Start menu. To pin the Excel program button, right-click the Excel icon in the Start menu and then click the Pin to Start item in the context menu. Windows then adds a large Excel program icon to the bottom of the first column of pinned icons. You can then resize the icon (right-click and select Resize followed by Small or Medium) and move it to a more desirable location in pinned section by dragging and dropping it.

TIP After launching Excel from the Start menu, you can pin the program icon to the Windows taskbar by right-clicking the Excel icon on the taskbar and selecting the Pin to Taskbar item. Thereafter, you can launch Excel from the Windows taskbar by clicking the pinned program icon without having to bother opening the Windows Start menu.

Starting Excel from the Windows Search text box

Instead of opening the Windows Start menu and locating the Excel item there, you can launch the program using the Windows Search text box (the one that contains the text “Type here to search" to the immediate right of the Windows button). Start typing *excel* into this text box until the Excel app appears at the top of its result list and then click the Excel result to launch the program.

Telling Cortana to Start Excel for you

If you want Cortana, the voice-activated online Windows assistant, to launch Excel for you, click the microphone icon in the Type Here to Search text box and then when she displays the listening prompt, say “Hey Cortana, start Excel.” You can also do this by telling her to “launch, Excel” or “open Excel” after getting her attention.

Starting Excel from the Windows Metro view in Tablet mode

TIP When running Excel in tablet mode under Windows, your Start screen uses tiles in the Metro view first introduced in Windows 8. To start Excel from this Start screen, select the Excel program tile either by clicking it if you have a mouse available or tapping it with your finger or stylus.

If you can't locate the Excel program tile among the pinned tiles in the Metro view, you can use the Search feature to find the application and pin it to this Start screen:

1. **From the Start screen, click the Search button on the Windows taskbar (the one with the spyglass icon between the Back and Task View buttons) and then begin typing** excel **on your physical or virtual keyboard.**

   Windows displays the Excel app in the list under Best Match in the search list.

   If you don't have access to a physical or virtual keyboard, you can locate the Excel app by switching the Start screen from the default of displaying just the pinned tiles to all the applications installed on your device. To do this, tap the All Apps button immediately beneath the Pinned Tiles button, the third icon from the top in the upper-left of the Start screen. When you do this, you should see the Excel app button in the E alphabetical listing of all installed applications.

2. **Right-click the Excel app button in the search list to open its pop-up menu.**

   On a touchscreen device, the equivalent to the right-click of the mouse is to tap and hold the Excel menu item with your finger or stylus until the popup menu appears. (With the Microsoft Pen, you hold down the button on the pen's side as you tap the Excel app button with the pen tip.)

3. **Click the Pin to Start option in the pop-up menu.**

After pinning an Excel program tile to the Start screen, you can resize it and then move it by dragging and dropping it in your desired block. If you switched to all apps to find the Excel app, you first need to switch the Metro view back to pinned apps by tapping the Pinned Tiles button before you can do this.

When it's quitting time

When you're ready to call it a day and quit Excel, you have several choices for shutting down the program:

- Press Alt+FX or Alt+F4 on your physical or Touch keyboard.
- Select the Close button (the one with the *x*) in the upper-right corner of the Excel program window to close each workbook file you have open.
- Right-click the Excel program icon on the Windows taskbar and then click the Close Window(s) option on its pop-up menu.

If you try to exit Excel after working on a workbook and you haven't saved your latest changes, the program beeps at you and displays an alert box querying whether you want to save your changes. To save your changes before exiting, click the Yes command button. (For detailed information on saving documents, see Book 1, Chapter 2.) If you've just been playing around in the worksheet and don't want to save your changes, you can abandon the document by clicking the No button.

TIP

QUITTING EXCEL ON A TOUCHSCREEN DEVICE

If you’re running Excel on a touchscreen device without a physical keyboard (even one with a relatively large screen), for heaven’s sake, don’t forget to engage the touch spacing on the Quick Launch toolbar as described earlier in this chapter. Turning on touch spacing sufficiently separates the Close button in the very upper-right corner of the Excel screen from the Restore Down button to its immediate left, so that when you tap the Close button, you end up actually exiting Excel rather than just shrinking the Excel program window on the Windows desktop!

Chapter 2

Customizing Excel

IN THIS CHAPTER

- **Customizing the Quick Access toolbar and Ribbon**
- **Changing various and sundry Excel program settings**
- **Extending Excel's capabilities with add-in programs**

Chances are good that Excel, as it comes when first installed, is *not* always the best fit for the way you use the program. For that reason, Excel offers a variety of ways to customize and configure the program's settings so that they better suit your needs and the way you like to work.

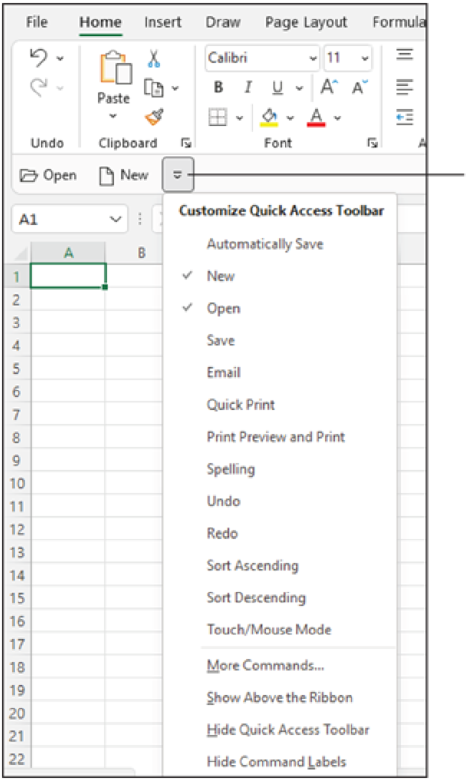
This chapter covers the most important methods for customizing Excel settings and features. The chapter looks at three basic areas where you can tailor the program to your individual needs:

- The first place ripe for customization is the Quick Access toolbar (assuming you elected to unhide it, as I describe in Book 1, Chapter 1). Not only can you control which Excel command buttons appear on this toolbar, but you can also assign macros you create to this toolbar, making those macros instantly accessible.
- The second place where you may want to make extensive modifications is to the default settings (also referred to as options) that control any number of program assumptions and basic behaviors.
- The third place where you can customize Excel is in the world of add-ins, those small, specialized utilities that extend the built-in Excel features by attaching themselves to the main Excel program. Excel Add-ins provide a wide variety of functions and are available from a wide variety of sources, including the original Excel program, the Microsoft Office website, and third-party vendors.

Tailoring the Quick Access Toolbar to Your Tastes

Excel enables you to easily make modifications to the Quick Access toolbar, the sole toolbar of the program. When you unhide the Quick Access toolbar (by, for example, right-clicking the Ribbon and then clicking Show Quick Access Toolbar), it appears right below the Ribbon.

To add some commonly used commands to the Quick Access toolbar, such as New, Open, Email, Quick Print, and the like, click the Customize Quick Access Toolbar button (pointed out in Figure 2-1) and click the command to be added from the drop-down menu. Notice that Excel adds a check mark to the left of each command that's been added to the Quick Access Toolbar. To remove one of these commands, click Customize Quick Access Toolbar and then click the command to remove its check mark.


File
Home
Insert
Draw
Page Layout
Formula
Paste
Calibri
11
Undo
Clipboard
Font
Open
New
A1
A
B
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
Customize Quick Access Toolbar
Automatically Save
✓ New
✓ Open
Save
Email
Quick Print
Print Preview and Print
Spelling
Undo
Redo
Sort Ascending
Sort Descending
Touch/Mouse Mode
More Commands...
Show Above the Ribbon
Hide Quick Access Toolbar
Hide Command Labels

Customize Quick Access Toolbar

FIGURE 2-1: Click Customize Quick Access Toolbar to see a few useful commands that you can tack on to the toolbar.

TIP If you use Excel on a touchscreen device, you'll want to add the Touch/Mouse Mode button to the Quick Access toolbar by selecting the Touch/Mouse Mode option on the Customize Quick Access Toolbar menu. Touch/Mouse Mode enables you to switch Excel in and out of touch spacing (engaged by default). Touch spacing puts more space between the command buttons on each tab of the Excel Ribbon, thus making it a whole lot easier to select the correct command with either your finger or stylus. Even when running Excel on a computer without any touch capabilities, you can still add the Touch/Mouse Mode button to the Quick Access toolbar and use touch spacing to make it easier to select Tab commands with your mouse.

Adding Ribbon commands to the Quick Access toolbar

Excel makes it super-easy to add a command from any tab on the Ribbon to the Quick Access toolbar. To add a Ribbon command, right-click its command button on the Ribbon and then click Add to Quick Access Toolbar. Excel adds the command button to the very end of the Quick Access toolbar, immediately to the left of the Customize Quick Access Toolbar button.

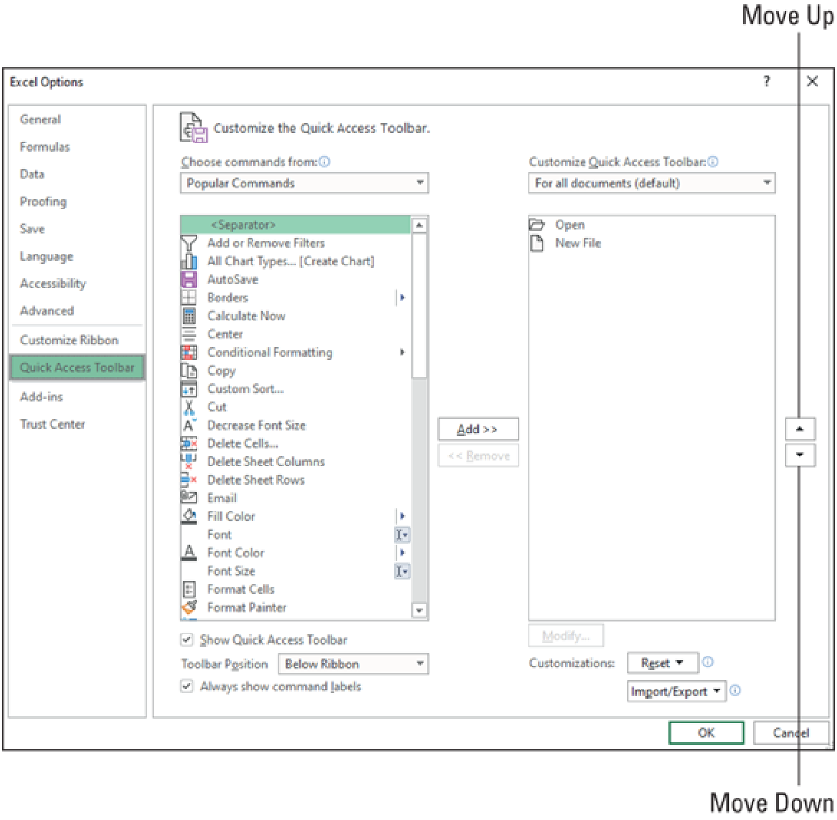
If you want to move the command button to a new location on the Quick Access toolbar or group it with other buttons on the toolbar, you need to click the Customize Quick Access Toolbar button and then click More Commands.

Excel then opens the Excel Options dialog box with the Quick Access Toolbar tab selected (similar to the one shown in Figure 2-2). Here, Excel shows all the buttons currently added to the Quick Access toolbar in the order in which they appear from left to right on the toolbar corresponding to their top-down order in the list box on the right side of the dialog box.

To reposition a particular button on the bar, click it in the list box on the right and then click either the Move Up button or the Move Down button (pointed out in Figure 2-2) until the button is promoted or demoted to the desired position on the toolbar.

REMEMBER You can add separators to the toolbar to group related buttons. To do this, click the <Separator> selection at the top of the list box on the left and then click the Add button twice to add two. Then, click the Move Up or Move Down button to position one of the two separators at the beginning of the group and the other at the end. You can always return the Quick Access toolbar to its default button-free state by choosing Reset ⇒ Reset Only Quick Access Toolbar.

TIP If you've added too many buttons to the Quick Access toolbar and can no longer read the workbook name, you can reposition the Quick Access toolbar so that it appears beneath the Ribbon immediately on top of the Formula bar. To do this, click the Customize Quick Access Toolbar button at the end of the toolbar and then click Show Below the Ribbon.



Move Up
Excel Options
?
×
General
Formulas
Data
Proofing
Save
Language
Accessibility
Advanced
Customize Ribbon
Quick Access Toolbar
Add-ins
Trust Center
<Separator>
Add or Remove Filters
All Chart Types... [Create Chart]
AutoSave
Borders
Calculate Now
Center
Conditional Formatting
Copy
Custom Sort...
Cut
Decrease Font Size
Delete Cells...
Delete Sheet Columns
Delete Sheet Rows
Email
Fill Color
Font
Font Color
Font Size
Format Cells
Format Painter
Add >>
<< Remove
Open
New File
Modify...
Customizations:
Reset
Import/Export
OK
Cancel
Move Down

Customize the Quick Access Toolbar.

Choose commands from: Popular Commands

Customize Quick Access Toolbar: For all documents (default)

☑ Show Quick Access Toolbar

Toolbar Position: Below Ribbon

☑ Always show command labels

FIGURE 2-2: Use the buttons on the Quick Access Toolbar tab of the Excel Options dialog box to customize the appearance of the Quick Access toolbar.

Adding non-Ribbon commands to the Quick Access toolbar

You can also use the options on the Quick Access Toolbar tab of the Excel Options dialog box (refer to Figure 2-2) to add a button for any Excel command even if it's not one of those displayed on the tabs of the Ribbon:

1. **Select the type of command you want to add to the Quick Access toolbar from the Choose Commands From drop-down list box.**

   The types of commands include the default Popular Commands, Commands Not in the Ribbon, All Commands, and Macros, as well as each of the standard and contextual tabs that can appear on the Ribbon. To display only the commands not displayed on the Ribbon, click Commands Not in the Ribbon near the top of the drop-down list. To display a complete list of all the Excel commands, click All Commands.

2. **Click the command whose button you want to add to the Quick Access toolbar in the Choose Commands From list box on the left.**
3. **Click the Add button to add the command button to the bottom of the list box on the right.**

TIP

ADDING COMMANDS LOST FROM EARLIER EXCEL VERSIONS TO THE QUICK ACCESS TOOLBAR

Although certain commands from earlier versions of Excel, such as Data ⇒ Form and View ⇒ Web Page Preview, did not make it to the Ribbon in Excel, this does not mean that they were entirely eliminated from the program. The only way, however, to revive these commands is to add their buttons to either the Quick Access toolbar or to the Ribbon after clicking the Commands Not in the Ribbon category from the Choose Commands From drop-down list on the Customization tab of the Excel Options dialog box.

4. **(Optional) To reposition the newly added command button so that it's not the last one on the toolbar, click the Move Up button until it's in the desired position.**
5. **(Optional) Repeat Steps 1 through 4 to add as many commands to the Quick Access toolbar as you feel like.**
6. **Click OK to close the Excel Options dialog box.**

Exercising Your Options

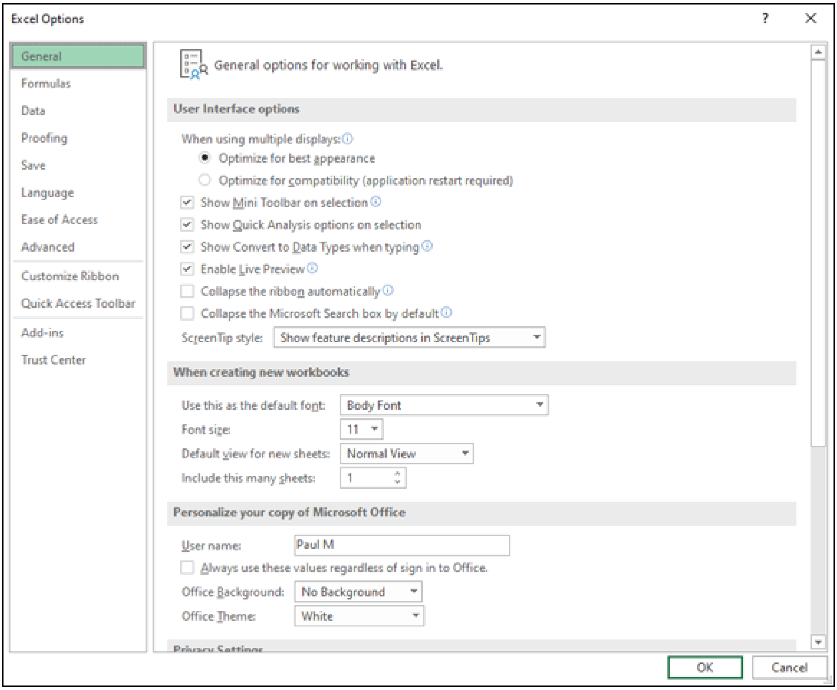
Each time you open a new workbook, Excel makes a whole bunch of assumptions about how you want to interact with the program, how your worksheet data appears, how Excel calculates formula results, and much more. These assumptions may or may not fit the way you work and the kinds of worksheets you need to create.

In the following five sections, you get a quick rundown on how to change the most important default or *preference* settings in the Excel Options dialog box. This dialog box is the biggest Excel has, with a billion tabs (12 actually). From the Excel Options dialog box, you can control what things appear onscreen and how they appear, as well as when and how Excel calculates worksheets.

TIP Nothing discussed in the following five sections is critical to your being able to operate Excel. Just remember the Excel Options dialog box if you find yourself futzing with the same setting over and over again in most of the workbooks you create. In such a situation, it's high time to get into the Excel Options dialog box and modify that setting so that you won't waste any more time tinkering with the same setting in future workbooks.

Changing some of the more universal settings on the General tab

The General tab (shown in Figure 2-3) is the first tab in the Excel Options dialog box. This tab is automatically selected whenever you first open this dialog box by choosing File ⇒ Options or by pressing Alt +FT.



General options for working with Excel.

User Interface options

When using multiple displays:
● Optimize for best appearance
○ Optimize for compatibility (application restart required)
☑ Show Mini Toolbar on selection
☑ Show Quick Analysis options on selection
☑ Show Convert to Data Types when typing
☑ Enable Live Preview
☐ Collapse the ribbon automatically
☐ Collapse the Microsoft Search box by default
ScreenTip style: Show feature descriptions in ScreenTips

When creating new workbooks

Use this as the default font: Body Font
Font size: 11
Default view for new sheets: Normal View
Include this many sheets: 1

Personalize your copy of Microsoft Office

User name: Paul M
☐ Always use these values regardless of sign in to Office.
Office Background: No Background
Office Theme: White

FIGURE 2-3: The General tab's options enable you to change many global Excel settings.

The options on the General tab are arranged into six groups: User Interface Options, When Creating New Workbooks, Personalize Your Copy of Microsoft Office, Privacy Settings, LinkedIn Features, and Start Up Options.

The User Interface Options group

The User Interface Options group contains the following check boxes and buttons:

- **When Using Multiple Displays:** Select the Optimize for Best Appearance setting to have the Excel program window plus whatever other windows you have open on the connected display screens look their very best. If you find that your Excel windows lose elements (such as scroll bars) when you drag them from one display to another, select the Optimize for Compatibility setting instead.
- **Show Mini Toolbar on Selection:** Toggles the display of the mini-toolbar, which contains essential formatting buttons from the Home tab, above a cell selection or other object's shortcut menu when you right-click it.

- **Show Quick Analysis Options on Selection:** Toggles the appearance of the Quick Access toolbar in the lower-right corner of a cell selection. The Quick Analysis toolbar contains options for applying formatting to the selection as well as creating new charts and PivotTables using its data.

- **Show Convert to Data Types When Typing:** Toggles the display of the Convert to Data Type option when you're entering worksheet items that Excel thinks may match a data type category, such as Stocks or Geography.

- **Enable Live Preview:** Toggles the Live Preview feature where Excel previews the data in the current cell selection using the font or style you highlight in a drop-down list or gallery before you actually apply the formatting.

- **Collapse the Ribbon Automatically:** When selected, configures Excel to automatically show only the Ribbon's tab names when you reduce the Excel window below a certain size. Restart Excel to put this setting into effect.

- **Collapse the Microsoft Search Box by Default:** When selected, replaces the Search text box that appears in the Excel title bar with the Search icon (a magnifying glass).

- **ScreenTip Style:** Changes the way ScreenTips (which display information about the command buttons you highlight with the mouse) are displayed onscreen. Click Don’t Show Feature Descriptions in ScreenTips from the ScreenTip Style drop-down list to display a minimum amount of description in the ScreenTip and eliminate all links to online help, or click Don’t Show ScreenTips to completely remove the display of ScreenTips from the screen (potentially confusing if you add macros to the toolbar that all use the same icon).

The When Creating New Workbooks group

The options in the When Creating New Workbooks group of the Popular tab of the Excel Options dialog box include only these four combo and text boxes:

- **Use This as the Default Font:** Select a new default font to use in all cells of new worksheets by entering the font name in the combo box or clicking its name in the drop-down list (Body Font, which is actually Microsoft’s Calibri font).

- **Font Size:** Select a new default size to use in all cells of new worksheets (11 points is the default size) by entering the value in the box or by clicking this new point value in the drop-down list.

- **Default View for New Sheets:** Select either Page Break Preview (displaying page breaks that you can adjust) or Page Layout (displaying page breaks, rulers, and margins) as the default view (rather than Normal) for all new worksheets.
- **Include This Many Sheets:** Change the default number of worksheets in each new workbook (1 being the default) by entering a number between 2 and 255 or select this new number by clicking the spinner buttons.

The Personalize Your Copy of Microsoft Office group

The Personalize Your Copy of Microsoft Office group contains the following three options:

- **User Name:** This text box enables you to change the username that's used as the default author for new workbooks created with Excel.
- **Office Background:** This drop-down list enables you to select a faint background pattern to be displayed on the right side of the Excel program window where your name, the Ribbon Display Options, and Minimize, Restore, and Close buttons all appear. To switch back to the default of no pattern in this area of the screen after selecting one of the available background patterns, click the No Background option at the top of this drop-down list.
- **Office Theme:** This drop-down list enables you to select between a half dozen tint options — Black, Colorful, Dark Gray, Light Gray, Use System Setting, and White — that are applied to the borders of the Excel screen, creating a kind of background color for the Ribbon tabs, column letter and row number indicators on the worksheet frame, and the Status bar.

REMEMBER When you select the Always Use These Values Regardless of Sign In to Office check box in the Personalize Your Copy of Microsoft Office group, the username, background pattern, and theme you select for the User Name, Office Background, and Office Theme options are applied to all the Office application programs that you use, such as Word, PowerPoint, and so on.

The Privacy Settings group

This group includes just a single button named Privacy Settings. Clicking this button opens the Privacy Settings dialog box, which contains a series of check boxes that control the types of Office data that are shared with Microsoft. For greater privacy, deselect more of the check boxes, although know that some Excel features may no longer work as advertised or at all.

The LinkedIn Features group

The Enable LinkedIn Features In My Office Application check box is enabled by default. The Office LinkedIn features are really used more in Office programs such as Outlook and Word to keep you better connected to the people in your network.

The Start Up Options group

The final group, Start Up Options, contains the following three settings:

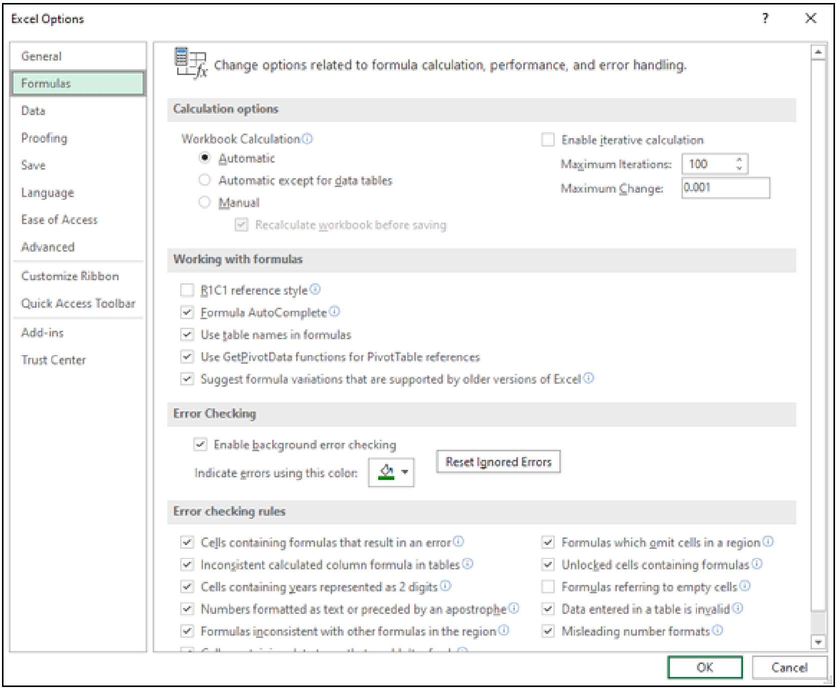
- **Choose the Extensions You Want Excel to Open by Default:** The Default Programs button, when clicked, displays a dialog box telling you to open Windows' Settings app and then choose Apps ⇒ Default Apps. In the Default Apps screen, click Choose Default Apps by File Type, which enables you to select all the types of application files that you want associated with Excel. Once associated with Excel, double-clicking any file carrying its extension automatically launches Excel for viewing and editing.
- **Tell Me if Microsoft Excel Isn’t the Default Program for Viewing and Editing Spreadsheets:** This check box determines whether you’re informed should another spreadsheet program or viewer on your computer other than Excel be associated with opening Excel workbook files.
- **Show the Start Screen When This Application Starts:** This check box determines whether the Start screen (described in detail in Book 1, Chapter 1) appears when you launch Excel.

TIP

If you always choose the Blank Workbook template when you start Excel, deselect the Show the Start Screen When This Application Starts check box. Now, whenever you launch Excel, the program immediately opens a new, blank workbook file in the worksheet view, skipping entirely the Excel Backstage view. You're welcome.

Changing common calculation options on the Formulas tab

The options on the Formulas tab (see Figure 2-4) of the Excel Options dialog box (File ⇒ Options ⇒ Formulas or Alt + FTF) are divided into Calculation Options, Working with Formulas, Error Checking, and Error Checking Rules.



Change options related to formula calculation, performance, and error handling.

Calculation options

Workbook Calculation
● Automatic
○ Automatic except for data tables
○ Manual
☑ Recalculate workbook before saving

☐ Enable iterative calculation
Maximum Iterations: 100
Maximum Change: 0.001

Working with formulas

☐ R1C1 reference style
☑ Formula AutoComplete
☑ Use table names in formulas
☑ Use GetPivotData functions for PivotTable references
☑ Suggest formula variations that are supported by older versions of Excel

Error Checking

☑ Enable background error checking
Indicate errors using this color:

Error checking rules

☑ Cells containing formulas that result in an error
☑ Inconsistent calculated column formula in tables
☑ Cells containing years represented as 2 digits
☑ Numbers formatted as text or preceded by an apostrophe
☑ Formulas inconsistent with other formulas in the region
☑ Formulas which omit cells in a region
☑ Unlocked cells containing formulas
☐ Formulas referring to empty cells
☑ Data entered in a table is invalid
☑ Misleading number formats

FIGURE 2-4: The Formulas tab's options enable you to change how Excel works with formulas.

The Calculation Options group

The Calculation Options enable you to change when formulas in your workbook are recalculated and how a formula that Excel can't solve on the first try (such as one with a circular reference) is recalculated. Choose from the following items:

- **Automatic:** Excel recalculates all formulas immediately after you modify any of the values on which their calculation depends (this is the default).
- **Automatic Except for Data Tables:** Excel automatically recalculates all formulas except for those entered into what-if data

tables you create. (See Book 7, Chapter 1.) To update these formulas, you must click the Calculate Now (F9) or the Calculate Sheet (Shift + F9) command button on the Formulas tab of the Ribbon.

- **Manual:** Excel doesn't recalculate formulas automatically. Instead, you now use manual recalculation, where formulas that need updating get recalculated only when you click the Calculate Now (F9) or the Calculate Sheet (Shift + F9) command button on the Formulas tab of the Ribbon. If you leave the Recalculate Workbook Before Saving check box selected, Excel recalculates the workbook's formulas each time you save the file.
- **Enable Iterative Calculation:** Toggles iterative calculations for formulas that Excel can't solve on the first try. (See Book 3, Chapter 1.) If you select this check box, then you can also modify the following two related options:
    - *Maximum Iterations:* Sets the number of times (100 is the default) that Excel iteratively recalculates a seemingly insolvable formula. Enter a number between 1 and 32767 in the text box or click the spinner buttons.
    - *Maximum Change:* Sets the amount by which Excel increments the guess value it applies each time the program iteratively recalculates the formula in an attempt to solve it by entering the new increment value in the text box.

The Working with Formulas options group

The Working with Formulas group contains four check boxes that determine a variety of formula-related options:

- **R1C1 Reference Style:** Toggles the R1C1 cell reference style, which uses numbers for both rows and columns, preceded by R and C, respectively. Row 1 is R1, row 2 is R2, and so on; similarly, column A is C1, column B is C2, and so on. For example, R45C2 refers to cell B45. (Just so you know, Excel's default cell referencing — letters for columns and numbers for rows — is called the A1 cell reference style.)
- **Formula AutoComplete:** Toggles the Formula AutoComplete feature where Excel attempts to complete the formula or function you’re manually building in the current cell.
- **Use Table Names in Formulas:** Toggles the feature where Excel automatically applies all range names you’ve created in a table of

data to all formulas that refer to their cells. (See Book 3, Chapter 1.)

- **Use GetPivotData Functions for PivotTable References:** Toggles the GetPivotTable function that Excel uses to extract data from specified fields in a data source when placing them in a PivotTable summary report you’re creating. (See Book 7, Chapter 2 for details.)
- **Suggest Formula Variations That Are Supported by Older Versions of Excel:** Toggles the Excel feature that suggests alternative formulas that are compatible with older versions of Excel. This option mostly deals with Excel's dynamic arrays, which are not supported in Excel 2019 and earlier. (See Book 3, Chapter 1.)

The Error Checking and Error Checking Rules groups

The remaining options on the Formulas tab of the Excel Options dialog box enable you to control error-checking for formulas.

In the Error Checking group, the sole check box, Enable Background Error Checking, which enables error-checking in the background while you’re working in Excel, is checked.

In the Error Checking Rules, all the check boxes are checked, with the exception of the Formulas Referring to Empty Cells check box, which indicates a formula error when a formula refers to a blank cell.

REMEMBER To disable background error checking, click the Enable Background Error Checking check box in the Error Checking group to remove its check mark. To change the color used to indicate formula errors in cells of the worksheet (when background error checking is engaged), click the Indicate Errors Using This Color drop-down button and click a new color square on its drop-down color palette. To remove the color from all cells in the worksheet where formula errors are currently indicated, click the Reset Ignore Errors button. To disable other error-checking rules, click their check boxes to remove the check marks.

Digging the options on the Data tab

The Data Options group on the Data tab of the Excel Options dialog box contains four check boxes. These options control the way that Excel handles huge amounts of data that you can access in Excel through external data queries discussed in Book 6, Chapter 2 or through Excel's PivotTable feature (especially when using the Power Pivot add-in) discussed in Book 7, Chapter 2.

By default, Excel disables the undo feature when refreshing data in a PivotTable created from external data that has more than 300,000 source rows (also called *records*) to significantly reduce the data refresh time. To modify the minimum number of source rows at which the Undo Refresh feature is disabled, enter a new number (representing thousands of records) in the text box containing the default value of 300 under the Disable Undo for Large PivotTable Refresh Operations check box or select the new value with the spinner buttons. To enable the undo feature for all refresh operations in your large PivotTables (regardless of how long the refresh operation takes), deselect the Disable Undo for Large PivotTable Refresh Operations check box.

Excel also automatically disables the Undo feature for Excel tables that are created from related external database tables (referred to in Excel as a *data model*) that exceed 8MB in size. To change the minimum size at which the Undo feature is disabled, enter a new number (representing megabytes) in the text box containing the default value of 8 under the Disable Undo for Large Data Model Operations check box or select this new value with the spinner buttons. To enable the Undo feature for all operations involving tables created from an external data model (regardless of how long the undo operation takes), deselect the Disable Undo for Large Data Model Operations check box.

TIP

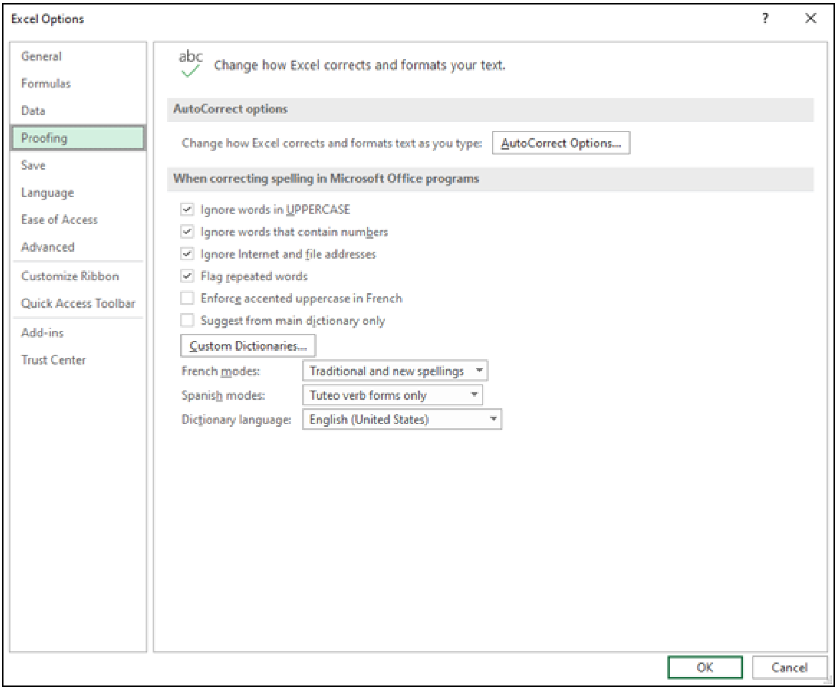
If you want Excel to automatically assume that any external data used in creating new PivotTables or imported into tables from external data queries involve a data model so that Excel automatically looks for the fields that are related in the files you designate, select the Prefer the Excel Data Model When Creating PivotTables, QueryTables, and Data Connections check box.

In addition to Data Options, the Data tab contains a Show Legacy Data Import Wizards group with a number of unselected check boxes for each of the wizards that earlier versions of Excel used to import particular types of data, such as tables from Microsoft Access databases, web page queries, or text files.

TIP As Excel has greatly improved its data import capabilities for automatically recognizing and parsing data imported into one of its worksheets, selecting any of these so-called Legacy Import Wizards is unnecessary unless you have extensive experience with these older import engines *and* find that Excel's data intelligence capabilities are having trouble properly importing data from one of these external sources on which your work depends.

Changing correction options on the Proofing tab

The options on the Proofing tab (see Figure 2-5) of the Excel Options dialog box (File ⇒ Options ⇒ Proofing or Alt + FTP) are divided into two groups: AutoCorrect Options and When Correcting Spelling in Microsoft Office Programs.


Excel Options
?
General
Formulas
Data
Proofing
Save
Language
Ease of Access
Advanced
Customize Ribbon
Quick Access Toolbar
Add-ins
Trust Center
abc
AutoCorrect options
When correcting spelling in Microsoft Office programs
AutoCorrect Options...
Custom Dictionaries...
OK
Cancel

Change how Excel corrects and formats your text.

Change how Excel corrects and formats text as you type:

☑ Ignore words in UPPERCASE
☑ Ignore words that contain numbers
☑ Ignore Internet and file addresses
☑ Flag repeated words
☐ Enforce accented uppercase in French
☐ Suggest from main dictionary only

French modes: Traditional and new spellings
Spanish modes: Tuteo verb forms only
Dictionary language: English (United States)

FIGURE 2-5: The Proofing tab's options enable you to change AutoCorrect and spell-checking options.

The AutoCorrect Options group

Click the AutoCorrect Options button to open the AutoCorrect dialog box for the primary language used in Microsoft Office. This dialog box contains the following four tabs:

- **AutoCorrect:** Offers options that control what corrections Excel automatically makes, an Exceptions button that enables you to indicate what words or abbreviations are not to be capitalized in the AutoCorrect Exceptions dialog box, and text boxes where you can define custom replacements that Excel makes as you type.
- **AutoFormat As You Type:** Comes with options that control whether to replace Internet addresses and network paths with hyperlinks, and to automatically insert new rows and columns to cell ranges defined as tables and copy formulas in calculated fields to new rows of a table.
- **Actions:** Includes an Enable Additional Actions in the Right-Click Menu check box and Available Actions list box that let you activate a date or financial symbol context menu that appears when you enter certain date and financial text in cells.
- **Math AutoCorrect:** Includes Replace and With text boxes that enable you to replace certain text with math symbols that are needed in your worksheets.

The When Correcting Spelling in Microsoft Office Programs group

The options in the When Correcting Spelling in Microsoft Office Programs group of the Proofing tab control what types of errors Excel flags as possible misspellings when you use the Spell Check feature. (See Book 2, Chapter 3.) This group also contains the following buttons:

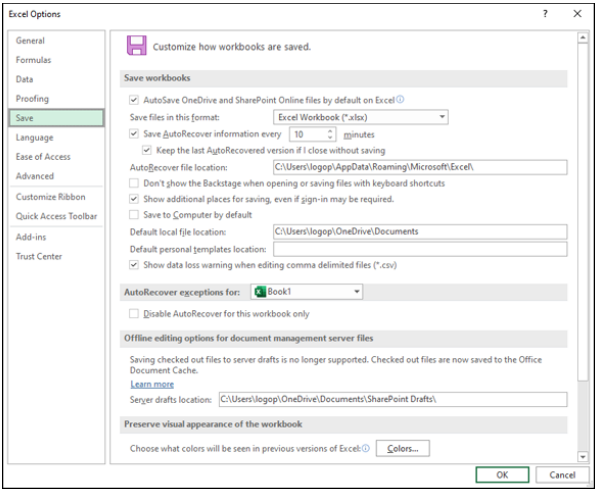
- **Custom Dictionaries:** Opens the Custom Dictionaries dialog box, where you can specify a new custom dictionary to use in spell checking the worksheet, define a new dictionary, and edit its word list.
- **French Modes** or **Spanish Modes:** Specify which forms of the respective language to use in proofing worksheet text.
- **Dictionary Language:** Specifies by language and country which dictionary to use in proofing worksheet text.

Changing save options on the Save tab

The options on the Save tab (see Figure 2-6) of the Excel Options dialog box (File ⇒ Options ⇒ Save or Alt + FTS) are divided into five groups: Save Workbooks, AutoRecover Exceptions for the current workbook (such as Book1), Offline Editing Options for Document Management Server Files, Preserve Visual Appearance of the Workbook, and Cache Settings.

Here are the options in the Save Workbooks group:

- **AutoSave OneDrive and SharePoint Online Files by Default on Excel:** With this option selected, Excel automatically saves all editing changes in all workbook files that you initially save in the cloud in a folder on your OneDrive or SharePoint site. Note that using the AutoSave feature gives you the benefit of seeing the editing changes made by others who are also working on the same workbook saved in the cloud in real time.
- **Save Files in This Format:** The default setting for this drop-down list is Excel Workbook, the XML-based file format first introduced in Excel 2007 that appends the .xlsx suffix to the filename. If you want Excel to automatically save your new workbook files in another file format (such as the old Excel workbook file format that uses the *.xls suffix), select that format (such as the Excel 97-2003 menu option in this drop-down list).



Customize how workbooks are saved.

Save workbooks

☑ AutoSave OneDrive and SharePoint Online files by default on Excel

Save files in this format: Excel Workbook (*.xlsx)

☑ Save AutoRecover information every 10 minutes

☑ Keep the last AutoRecovered version if I close without saving

AutoRecover file location: C:\Users\logop\AppData\Roaming\Microsoft\Excel\

☐ Don't show the Backstage when opening or saving files with keyboard shortcuts

☑ Show additional places for saving, even if sign-in may be required.

☐ Save to Computer by default

Default local file location: C:\Users\logop\OneDrive\Documents

Default personal templates location:

☑ Show data loss warning when editing comma delimited files (*.csv)

AutoRecover exceptions for: Book1

☐ Disable AutoRecover for this workbook only

Offline editing options for document management server files

Saving checked out files to server drafts is no longer supported. Checked out files are now saved to the Office Document Cache.

Learn more

Server drafts location: C:\Users\logop\OneDrive\Documents\SharePoint Drafts\

Preserve visual appearance of the workbook

Choose what colors will be seen in previous versions of Excel:

FIGURE 2-6: The Save tab's options enable you to change the automatic save and backup and recovery options.

- **Save AutoRecover Information Every *X* Minutes:**

Toggles AutoRecover and specifies the time interval that Excel uses to save workbook copies to use with the AutoRecover feature. With AutoRecover on the job, Excel saves copies of your entire Excel workbook at the interval displayed in the Minutes text box. The default is 10 minutes, but you can get a ton of work done in 10 minutes, so I suggest an AutoRecover interval of 1 or 2 minutes.

If your computer should crash or you suddenly lose power, the next time you start Excel, the program automatically displays an AutoRecover pane on the left side of the worksheet area. From this pane, you can open a copy of the workbook file that you were working on when this crash or power loss occurred. If this recovered workbook (saved at the time of the last AutoRecover) contains information that isn’t saved in the original copy (the copy you saved the last time you used the Save command before the crash or power loss), you can then use the recovered copy rather than manually reconstructing and re-entering the otherwise lost information. You may also use the recovered copy of a workbook should the original copy of the workbook file become corrupted in such a way that Excel can no longer open it. (This happens very rarely, but it *does* happen.)

- **Keep the Last AutoRecovered Version If I Close without Saving:** Toggles the feature where Excel retains the most recent AutoRecover copy if you click Don't Save when you close a workbook. If you realize that was a mistake, you can at least use AutoRecover to open that saved copy and perhaps salvage some of your lost work.
- **AutoRecover File Location:** Specifies the drive and folder location that Excel uses to store its AutoRecover copies.

WARNING Don’t disable the AutoRecover feature even if you have a battery backup system for your computer that gives you plenty of time to manually save your Excel workbook during any power outage. Disabling AutoRecover in no way protects you from data loss if your workbook file becomes corrupted or you hit the computer’s power switch by mistake.

- **Don’t Show the Backstage when Opening or Saving Files with Keyboard Shortcuts:** Normally, Excel shows the Open screen in the Backstage view whenever you press Ctrl+O to open a file for editing and the Save As screen when you press Ctrl+S or click the Save button on the Quick Access toolbar to save a new workbook. Select this check box if you want Excel to display the Open and Save dialog box in the Worksheet area (as was the case in previous versions of Excel) instead.
- **Show Additional Places for Saving, Even If Sign-in May Be Required:** When Excel opens the Save As screen in the Backstage view, the program automatically displays the buttons for signing into online services, such as your OneDrive or the SharePoint team site, on this screen. If you don’t save your files to the cloud or don’t have access to OneDrive, you can deselect this check box to remove such sign-in options from the Save As screen.
- **Save to Computer by Default:** If you prefer to save your workbook files locally on your computer’s hard drive or a virtual drive on a local area network to which you have access, select this check box.
- **Default Local File Location:** This text box contains the path to the local folder where Excel saves new workbook files by default when you click the Save to Computer by Default check box as described in the preceding bullet item.
- **Default Personal Templates Location:** If the templates that you commonly use in creating new Excel workbooks are located in a local folder on your computer’s hard drive or a network drive to which you have access, enter the folder’s entire pathname in this text box after clicking the Save to Computer by Default check box as described earlier.

- **Show Data Loss Warning When Editing Comma Delimited Files (*.csv):** When this option is selected, if you try to save a workbook using the CSV (comma-delimited) file format, Excel displays the Possible Data Loss information bar when it detects that workbook features may be lost during the save. It doesn't say *which* features may be lost, so if you're worried, you can always click Save As in the information bar to save the workbook in an Excel file format. However, most of the itme you're fine to save the workbook as a comma-delimited file.

In the AutoRecover Exception For group, you can turn off AutoRecover for a single workbook. (This is opposed to deselecting the Save AutoRecover Information Every *X* Minutes check box, which disables AutoRecover globally.) Use the drop-down list to select the workbook you want to use, and then select the Disable AutoRecover for This Workbook Only check box.

If your company enables you to share the editing of certain Excel workbooks through the Excel Services offered as part of SharePoint Services software, you can change the location where Excel saves drafts of the workbook files you check out for editing. By default, Excel saves the drafts of these checked-out workbook files locally on your computer's hard drive inside a SharePoint Drafts folder in the Documents folder. If your company or IT department prefers that you save these draft files on the web server that contains the SharePoint software, enter the network path in the Server Drafts Location text box.

TIP

If you share your Excel workbooks with workers who are still using older versions (97–2003) of Excel, use the Colors command button to determine which color in the Excel worksheet to preserve in formatted tables and other graphics when you save the workbook file for them using the Excel 97–2003 file format option. (See Book 2, Chapter 1.)

Changing the Office language preferences

The options on the Language tab of the Excel Options dialog box enable you to change the languages that Excel uses.

The Office Display Language group controls the language used for the Excel display — that is, the interface: tabs, buttons, the Ribbon, and so on. You can perform the following tasks in the Office Display Language group:

- **Add more display languages.** Click the Install Additional Display Languages from Office.com link. You go to a web page where you can download a language pack accessory for Office.
- **Change the display language priority order.** In the Office Display Language list, click the language you want to work with, and then click Move Up (higher priority) or Move Down (lower priority) to set the preferred position of the language within the list.
- **Set the preferred display language.** In the Office Display Language list, click the language you want to work with, and then click the Set as Preferred button.

The Office Authoring Languages and Proofing group controls the languages used for authoring and proofing worksheet data. You can perform the following tasks in the Office Authoring Languages and Proofing group:

- **Add an authoring language.** Click the Add a Language button, use the Add an Authoring Language list to select the language you want to add, and then click Add. Excel adds the language to the Office Authoring Languages and Proofing list.

  REMEMBER After you add the language, you may see the Proofing Available link to the right of the language. That link tells you that your work is not done because now you also need to install the associated language pack from the Office.com website. Click the Proofing Available link to display the language pack page, click Download, and then install the downloaded file.

- **Set the preferred authoring language.** In the Office Authoring Language and Proofing list, click the language you want to work with, then click the Set Preferred button.
- **Remove an authoring language.** In the Office Authoring Language and Proofing list, click the language you want to delete

and then click Remove. Restart Excel to put the change into effect.

Setting some accessibility options

The settings in the Ease of Access tab (File ⇒ Options ⇒ Ease of Access or Alt + FTE) offer several ways to make Excel more accessible for people with visual, hearing, or mobility challenges. I talk more about using these options to enhance Excel accessibility in Book 4, Chapter 3. So, for now, here's a quick look at the settings in the Ease of Access tab:

- **Keep Accessibility Checker Running While I Work:** When selected, runs Excel's Accessibility Checker in the background as you work. This is useful because the Accessibility Checker alerts you right away if any accessibility issues come up while you're working. If you leave this check box deselected, you can run the Accessibility Checker manually by selecting the Check Accessibility command on the Review tab.

- **Provide Feedback with Sound:** When selected, adds audio cues to many Excel actions, including screen changes and completed tasks (such as copying, pasting, or deleting data). If you select this check box, Excel enables the Sound Screen drop-down list, from which you can choose the sound effects you want: Modern or Classic. This option applies to all Office applications that support audio cues.

- **Provide Feedback with Animation:** When selected, adds animation effects to many Excel actions.

- **ScreenTip Style:** Sets the content of the ScreenTips that appear when you hover the mouse pointer over an Excel feature. By default, each ScreenTip shows the feature name and its description. Choose Don't Show Feature Descriptions in ScreenTips to see only the feature name in each ScreenTips. If you find that ScreenTips just get in your way, choose Don't Show ScreenTips to turn them off.

- **Show Function ScreenTips:** When selected, displays a ScreenTip showing a function's syntax while you enter that function into a cell. Deselect this option if function ScreenTips are a problem for you.

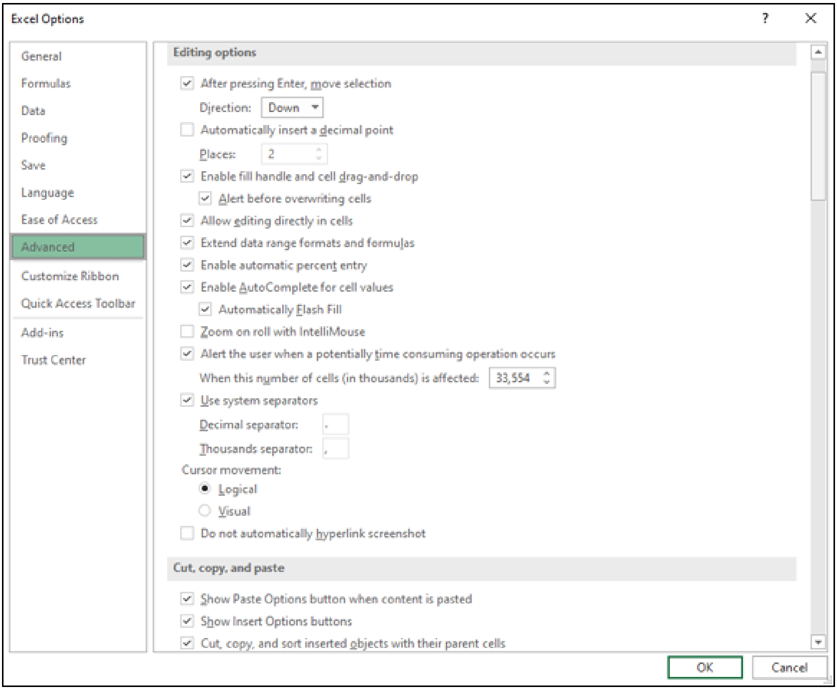
- **Show the Start Screen When this Application Starts:** Toggles the display of the Start screen when you launch Excel. If you have trouble negotiating this screen and prefer to start directly into Excel, deselect this check box.

- **Font size:** Sets the default font size that Excel uses for worksheet text.

Changing a whole lot of other common options on the Advanced tab

The options on the Advanced tab (see Figure 2-7) of the Excel Options dialog box (File ⇒ Options ⇒ Advanced or Alt + FTA) are divided into the 15 groups listed in Table 2-1.

The options in these 15 groups of the Advanced tab actually fall into four somewhat distinct areas: options for editing in the worksheet; options for controlling the screen display; and a potpourri area of formula, calculating, and general options.



Editing options

☑ After pressing Enter, move selection

Direction: Down

☐ Automatically insert a decimal point

Places: 2

☑ Enable fill handle and cell drag-and-drop

☑ Alert before overwriting cells

☑ Allow editing directly in cells

☑ Extend data range formats and formulas

☑ Enable automatic percent entry

☑ Enable AutoComplete for cell values

☑ Automatically Flash Fill

☐ Zoom on roll with IntelliMouse

☑ Alert the user when a potentially time consuming operation occurs

When this number of cells (in thousands) is affected: 33,554

☑ Use system separators

Decimal separator: .

Thousands separator: ,

Cursor movement:

● Logical

○ Visual

☐ Do not automatically hyperlink screenshot

Cut, copy, and paste

☑ Show Paste Options button when content is pasted

☑ Show Insert Options buttons

☑ Cut, copy, and sort inserted objects with their parent cells

FIGURE 2-7: The Editing and Cut, Copy, and Paste options on the Advanced tab control how Excel behaves during editing.

TABLE 2-1 Advanced Excel Options

Option	*What It Does*
Editing Options	Changes the way you edit the worksheets you create
Cut, Copy, and Paste	Changes the way worksheet editing that involves cutting, copying, and pasting to and from the Clipboard works

Link Handling	When selected, configures the Office applications to open links to Office documents in the respective Office desktop apps; if you leave this check deselected, the same links open in the respective Office web apps, instead.
Pen	If you're using Excel on a tablet or other touchscreen device, this option makes digital ink (as when making entries with the Windows 10 touch keyboard) the default
Image Size and Quality	Controls how an image's data is used in a worksheet
Print	Controls whether high or regular quality is used for the graphic images in the printed worksheet
Chart	Controls how Excel deals with the charts you add to a worksheet
Display	Determines how elements (from recently used workbooks in the Backstage view to ruler units, the presence of the Formula bar, ScreenTips, and comments in the worksheet) appear onscreen
Display Options for This Workbook	Sets display options for the current workbook open in Excel
Display Options for This Worksheet	Sets display options for the currently selected worksheet in the workbook open in Excel
Formulas	Determines how Excel deals with calculating sophisticated formulas in the worksheets in your workbook
When Calculating This Workbook	Sets calculation parameters for the workbook open in Excel
General	Controls all-purpose options, including such diverse options as the workbook files that you want opened when Excel launches, how your workbooks appear on the web, and the creation of custom AutoFill lists
Lotus Compatibility	Sets general Lotus 1-2-3 compatibility in Excel
Lotus Compatibility Settings For	Sets Lotus 1-2-3 compatibility for a particular worksheet in the workbook open in Excel

Working the worksheet editing options

As you can see in Figure 2-7, the settings in the Editing Options and Cut, Copy, and Paste groups on the Advanced tab control what happens when you edit the contents of an Excel worksheet.

When you first open the Advanced tab of the Excel Options dialog box, all the check boxes in the Editing Options and Cut, Copy, and Paste groups are checked with the exception of these three:

- **Automatically Insert a Decimal Point:** When selected, automatically adds a decimal point to numeric worksheet entries using the number of decimal places in the Places text box. For example, if Places is 2 (the default value), entering 12345 into a cell converts to 123.45 when you confirm the entry. (See Book 2, Chapter 1 for details.)
- **Zoom on Roll with IntelliMouse:** When selected, increases or decreases the screen magnification percentage by 15 percent on each roll forward and back of the center wheel of a mouse that supports Microsoft's IntelliMouse technology. When this option isn't checked, Excel scrolls the worksheet up and down on each roll forward and back of the center wheel.
- **Do Not Automatically Hyperlink Screenshot:** When selected, prevents Excel from automatically creating hyperlinks to any screenshots that you take of the Windows desktop using the Screen

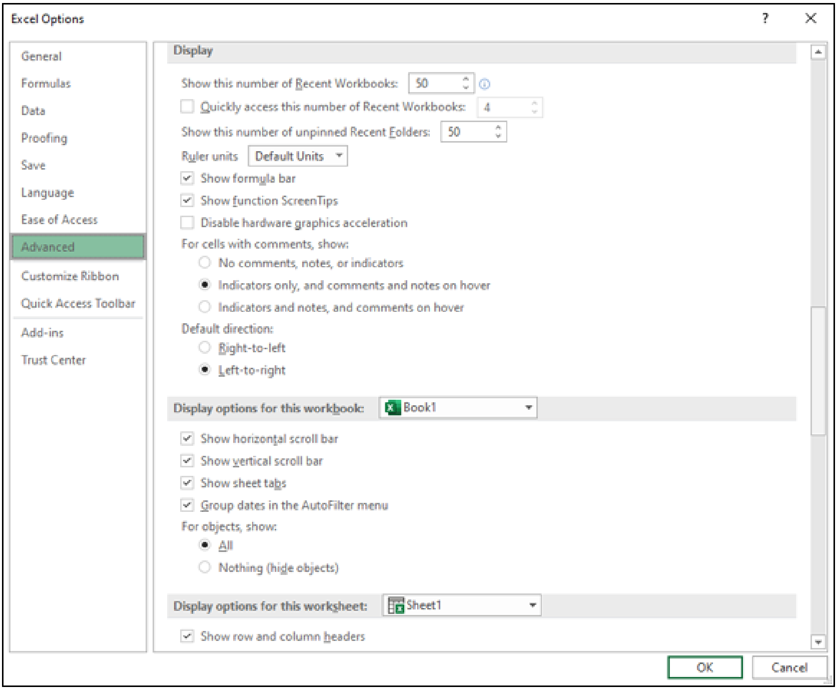
Clipping option on the Take a Screenshot button in the Illustrations group on the Insert tab of the Ribbon. (See Book 5, Chapter 2 for details.)

REMEMBER Most of the time, you'll want to keep all the other check boxes in the Editing Options and Cut, Copy, and Paste groups selected. The only one of these you may want to disengage is the Use System Separators check box when you routinely create worksheets with financial figures expressed in foreign currencies that don't use the period (.) as the decimal point and the comma (,) as the thousands separator. After you deselect the Use System Separators check box, the Decimal Separator and Thousands Separator text boxes become active, and you can then enter the appropriate punctuation into these two boxes.

TIP By default, Excel selects Down as the Direction setting when the After Pressing Enter, Move Selection check box is checked. If you want Excel to automatically advance the cell cursor in another direction (Right, Up, or Left), select the direction from its drop-down list. If you don't want Excel to move the cell cursor outside of the active cell upon completion of the entry (the same as clicking the Enter button on the Formula bar), deselect the After Pressing Enter, Move Selection check box.

Playing around with the display options

The display options in the middle of the Advanced tab of the Excel Options dialog box (see Figure 2-8) fall into three categories: general Display options that affect the Excel program; Display Options for This Workbook that affect the current workbook; and Display Options for This Worksheet that affect the active sheet in the workbook.



Display

Show this number of Recent Workbooks: 50

☐ Quickly access this number of Recent Workbooks: 4

Show this number of unpinned Recent Folders: 50

Ruler units Default Units

☑ Show formula bar

☑ Show function ScreenTips

☐ Disable hardware graphics acceleration

For cells with comments, show:

○ No comments, notes, or indicators

● Indicators only, and comments and notes on hover

○ Indicators and notes, and comments on hover

Default direction:

○ Right-to-left

● Left-to-right

Display options for this workbook: Book1

☑ Show horizontal scroll bar

☑ Show vertical scroll bar

☑ Show sheet tabs

☑ Group dates in the AutoFilter menu

For objects, show:

● All

○ Nothing (hide objects)

Display options for this worksheet: Sheet1

☑ Show row and column headers

FIGURE 2-8: The display options in the center of the Advanced tab control what's shown on the screen.

Most of the options in these three categories are self-explanatory as they either turn off or on the display of particular screen elements, such as the Formula bar, ScreenTips, scroll bars, sheet tabs, column and row headers, page breaks, (cell) gridlines, and the like.

REMEMBER When using these display options to control the display of Excel's screen elements, keep the following things in mind:

- The Ruler Units drop-down list box automatically uses the Default Units for your version of Microsoft Office (Inches in the U.S. and Centimeters in Canada and Europe). These default units (or those you specifically select from the drop-down list: Inches, Centimeters, or Millimeters) are then displayed on both the horizontal and vertical rulers that appear above and to the left of the column and row headings only when you put the Worksheet area display into Page Layout view (Alt+WP).

- Select the Indicators and Notes, and Comments on Hover option button under the For Cells with Comments, Show heading when you want Excel to always display the text boxes with the notes you add to cells. (For notes, see Book 4, Chapter 2; for comments, see Book 4, Chapter 3.)
- Select the Nothing (Hide Objects) option button under the For Objects, Show heading when you want Excel to hide the display of all graphic objects in the worksheet, including embedded charts, clip art, imported pictures, and all graphics that you generate in the worksheet. (See Book 5, Chapters 1 and 2 for details.)
- Deselect the Show Page Breaks check box to remove the dotted lines indicating page breaks in Normal (Alt + WN) view after viewing the Worksheet area in either Page Break Preview (Alt + WI) or Page Layout view (Alt + WP).
- Instead of going to the trouble of selecting the Show Formulas in Cells Instead of Their Calculated Results check box to display formulas in the cells of the worksheet, press Ctrl + ' (apostrophe) or click the Show Formulas button on the Formulas tab of the Ribbon. Both the keystroke shortcut and the button are toggles so that you can return the Worksheet area to its normal display showing the calculated results rather than the formulas by pressing the Ctrl + ' shortcut keys again or clicking the Show Formulas button.
- Instead of going to the trouble of deselecting the Show Gridlines check box whenever you want to remove the column and row lines that define the cells in the Worksheet area, click the Gridlines check box in the Show/Hide group on the View tab or the View check box in the Gridlines column of the Sheet Options group on the Page Layout tab to remove their check marks.

TIP Use the Gridline Color drop-down list button immediately below the Show Gridlines check box to change the color of the Worksheet gridlines (when they're displayed, of course) by clicking a new color on the color palette that appears when you click its drop-down list button.

Caring about the Formulas, Calculating, and General options

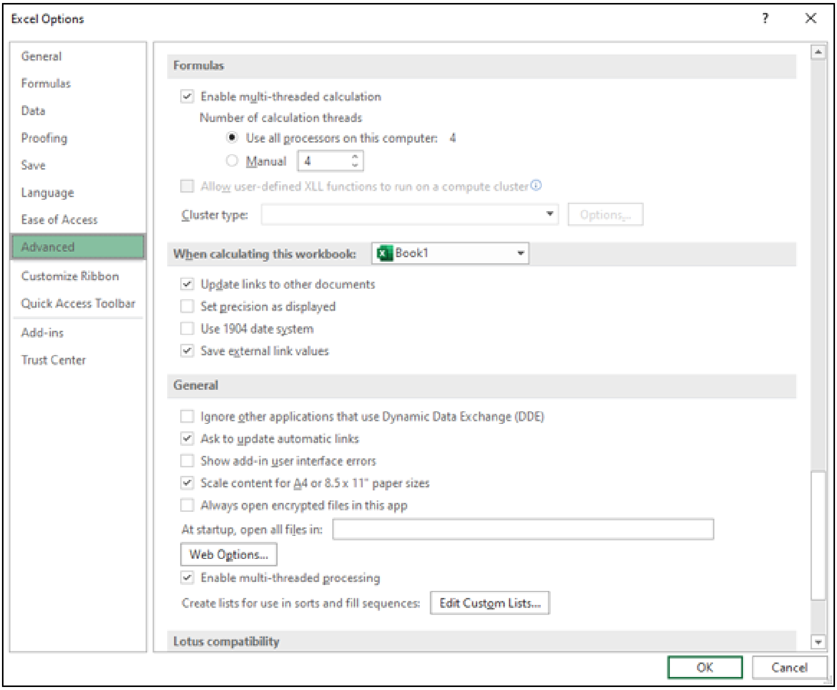
At the bottom of the Advanced tab of the Excel Options dialog box (see Figure 2-9), you find a regular mix of options in five groups. The first three groups, Formulas, When Calculating This Workbook, and General, contain a veritable potpourri of options.

Most of the settings in these three groups won't need changing. In rare cases, you may find that you have to activate the following options or make modifications to some of their settings:

- **Set Precision as Displayed:** Select this check box *only* when you want to permanently change the calculated values in the worksheet to the number of places currently shown in their cells as the result of the number format applied to them.
- **Use 1904 Date System:** Select this check box when you're dealing with a worksheet created with an earlier Macintosh version of Excel that used 1904 rather than 1900 as date serial number 1. (If all this is gibberish to you, see Book 3, Chapter 3 for enlightenment.)
- **Web Options:** Click this command button to display the Web Options dialog box, where you can modify the options that control how your Excel data appears when viewed with a web browser, such as Microsoft Edge.
- **Edit Custom Lists:** Click this command button to create or edit custom lists that you enter into the worksheet by using the Fill handle. (See Book 2, Chapter 1.)

Customizing the Excel Ribbon

The options on the Customize Ribbon tab (see Figure 2-10) of the Excel Options dialog box (File ⇒ Options ⇒ Customize Ribbon or Alt+FTC) enable you to modify which tabs appear on the Excel Ribbon and the order in which they appear, as well as to change which groups of command buttons appear on each of these displayed tabs. You can even use its options to create brand-new tabs for the Ribbon as well as create custom groups of command buttons within any of the displayed tabs.


Excel Options
?
General
Formulas
Data
Proofing
Save
Language
Ease of Access
Advanced
Customize Ribbon
Quick Access Toolbar
Add-ins
Trust Center
Options...
Web Options...
Edit Custom Lists...
OK
Cancel

Formulas

☑ Enable multi-threaded calculation

Number of calculation threads

● Use all processors on this computer: 4

○ Manual 4

☐ Allow user-defined XLL functions to run on a compute cluster

Cluster type:

When calculating this workbook: Book1

☑ Update links to other documents

☐ Set precision as displayed

☐ Use 1904 date system

☑ Save external link values

General

☐ Ignore other applications that use Dynamic Data Exchange (DDE)

☑ Ask to update automatic links

☐ Show add-in user interface errors

☑ Scale content for A4 or 8.5 x 11" paper sizes

☐ Always open encrypted files in this app

At startup, open all files in:

☑ Enable multi-threaded processing

Create lists for use in sorts and fill sequences:

Lotus compatibility

FIGURE 2-9: The Advanced tab options control calculation, general, and 1-2-3 compatibility settings.

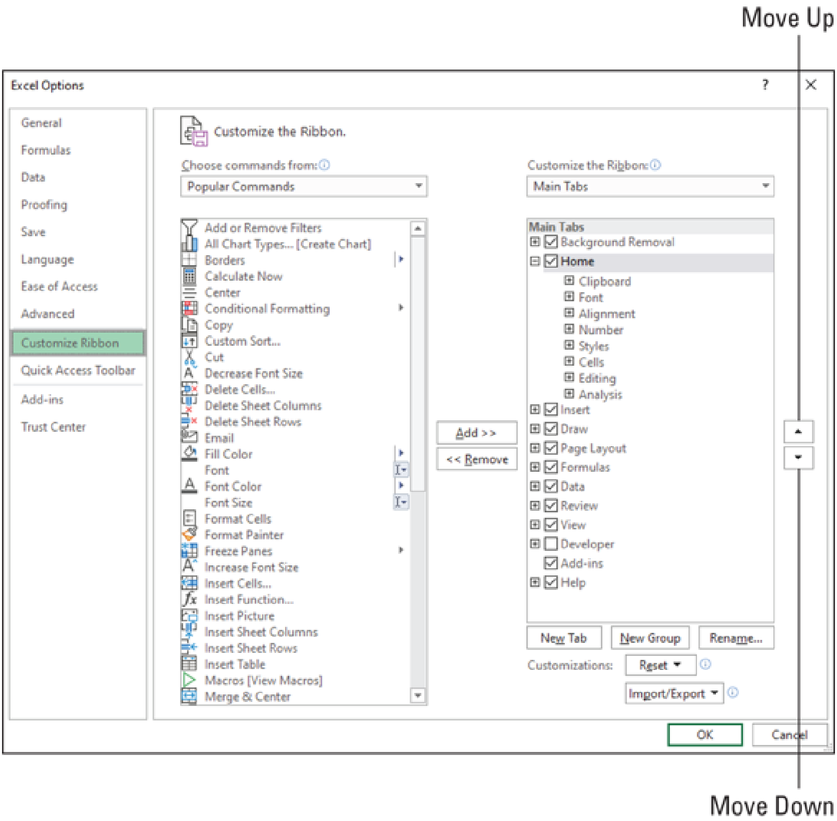
Customizing the Ribbon's tabs

If you find that the default arrangement of main tabs and groups on the Excel Ribbon is not entirely to your liking, you can simplify or rearrange them to suit the way you routinely work:

- **Hide a tab.** Deselect the tab's check box in the Main Tabs list box on the right side of the Excel Options dialog box. (To later redisplay the hidden tab, select its check box.)
- **Change a tab's position on the Ribbon.** In the Main Tabs list, select the tab to move and then click either the Move Up button or Move Down button (refer to Figure 2-10) until the name of the tab appears in the desired position in the Main Tabs list. (Note that moving a tab up in the list means the tab is shifted left on the Ribbon; similarly, moving a tab down in the list means the tab is shifted right on the Ribbon.)
- **Change a group's position within a tab.** In the Main Tabs list, for the tab that contains the group you want to work with, click the tab's Expand button (the plus sign) to display the tab's groups.

Next click the name of the group you want to reposition and click either the Move Up or Move Down button until it appears in the desired position in the list.

- **Remove a group from a tab.** In the Main Tabs list, for the tab that contains the group you want to remove, click the tab's Expand button (the plus sign) to display the tab's groups. Select the tab and then click the Remove command button.



Choose commands from: Popular Commands

Customize the Ribbon: Main Tabs

Move Up
Excel Options
?
×
General
Formulas
Data
Proofing
Save
Language
Ease of Access
Advanced
Customize Ribbon
Quick Access Toolbar
Add-ins
Trust Center
Customize the Ribbon.
Add or Remove Filters
All Chart Types... [Create Chart]
Borders
Calculate Now
Center
Conditional Formatting
Copy
Custom Sort...
Cut
Decrease Font Size
Delete Cells...
Delete Sheet Columns
Delete Sheet Rows
Email
Fill Color
Font
Font Color
Font Size
Format Cells
Format Painter
Freeze Panes
Increase Font Size
Insert Cells...
Insert Function...
Insert Picture
Insert Sheet Columns
Insert Sheet Rows
Insert Table
Macros [View Macros]
Merge & Center
Add >>
<< Remove
Main Tabs
⊞ ☑ Background Removal
⊟ ☑ Home
⊞ Clipboard
⊞ Font
⊞ Alignment
⊞ Number
⊞ Styles
⊞ Cells
⊞ Editing
⊞ Analysis
⊞ ☑ Insert
⊞ ☑ Draw
⊞ ☑ Page Layout
⊞ ☑ Formulas
⊞ ☑ Data
⊞ ☑ Review
⊞ ☑ View
⊞ ☐ Developer
☑ Add-ins
⊞ ☑ Help
New Tab
New Group
Rename...
Customizations:
Reset ▾
Import/Export ▾
OK
Cancel
Move Down

FIGURE 2-10: The Customize Ribbon tab options enable you to control which tabs are displayed on the Ribbon and which groups of command buttons they contain.

In addition to the main tabs of the Ribbon, you can control which groups of command buttons appear on its contextual tabs (such as the Table Design or Chart Design contextual tabs that automatically appear when you're working on an Excel table or chart):

- **Display the contextual tab groups you want to work with.** Use the Customize the Ribbon list to select Tool Tabs, which displays a list of all the contextual tabs. Click the Expand button (+) beside the contextual tab whose groups you want to work with.

- **Change a group's position within a contextual tab.** Click the group name and then click the Move Up or Move Down buttons to move the group into its new position.
- **Remove a group from a contextual tab.** Click the group and then click Remove.

TIP To restore the original groups to a particular tab or contextual tab you've modified, click the tab in the Customize the Ribbon list, click the Reset drop-down button beneath this list box, and then click Reset Only Selected Ribbon Tab.

WARNING If you want to restore all the tabs and groups on the Ribbon to their original default arrangement, you can click the Reset drop-down button and then click the Reset All Customizations option. Just be aware that clicking this option not only restores the Ribbon's default settings but also negates all changes you've made to the Quick Access toolbar at the same time. If you don't want this to happen, restore the tabs of the Ribbon individually by using the Reset Only Selected Ribbon tab option described in the preceding tip.

Adding custom tabs to the Ribbon

The Customize Ribbon tab of the Excel Options dialog box not only lets you customize the existing Ribbon tabs but also lets you add tabs of your own. This is great news if you want Ribbon access to Excel commands you routinely rely on that didn't make it to the default Ribbon or if you want to cram all your most-used commands into a single custom tab.

To add a brand-new tab to the Ribbon, follow these steps:

1. **Open the Customize Ribbon tab of the Excel Options dialog box (File ⇒ Options ⇒ Customize**

Ribbon or Alt+FTC).

Excel opens the Customize Ribbon tab with the Main Tabs selected in the Customize the Ribbon list box on the right.

2. **Under Main Tabs in this list box, click the tab that you want to come before the new tab you're about to insert.**

   Excel inserts the new tab after the one that's currently selected in the Customize the Ribbon list box. This means that if you want your new custom tab to appear at the beginning of the Ribbon, choose the Background Removal tab, which means Excel positions your custom tab just before the Home tab.

3. **Click New Tab.**

   Excel inserts a tab called New Tab (custom) with the single group called New Group (Custom) displayed and selected. This New Tab (Custom) is placed immediately after the currently selected tab.

4. **Add a command to this group on the custom tab by clicking the command in the Choose Commands From list and then clicking Add.**

   When adding commands, you can select them from any of the following categories available in the Choose Commands From drop-down list: Popular Commands, Commands Not in the Ribbon, All Commands, Macros, File Tab, All Tabs, Main Tabs, Tool Tabs, and Custom Tabs and Groups (which lists all custom tabs and groups you've previously created).

   Repeat Step 4 as needed to populate your custom tab with the commands you want.

   As you add each command from these categories, Excel displays the button's icon and name in the list beneath New Group (Custom) in the left-to-right order in which they'll appear. To change the order of these command buttons in the new group on the custom tab, click the Move Up and/or Move Down buttons.

5. **Rename the new group by clicking Rename to open the Rename dialog box, typing the new name in the Display Name text box, and then clicking OK.**
6. **(Optional) To add another group to the same custom tab, click New Group and then repeat Steps 4 and 5 to populate and rename the group.**

   Repeat Step 6 as often as you like to add additional groups of commands to the new custom tab. Use the Move Up and Move Down buttons if you need to reposition any groups on the custom tab.
7. **Rename the custom tab by clicking New Tab (Custom), clicking Rename to open the Rename dialog box, typing the new name in the Display Name text box, and then clicking OK.**

   To add additional custom tabs to the Ribbon, repeat Steps 2 through 7. After you finish all your custom tabs to the Ribbon, you're ready to close the Excel Options dialog box and return to the worksheet.
8. **Click OK.**

   When Excel closes this dialog box and returns you to the worksheet, the new custom tab appears in the Ribbon at the position where you placed it.

REMEMBER If you use shortcut keys to access Ribbon commands, keep in mind that Excel automatically assigns hot-key letters to each of the custom tabs and commands you add to the Ribbon. To display the custom tabs' hot keys, press the Alt key (or the / key). To display the hot keys assigned to the commands on a particular custom tab, type its specific hot-key letter.

TIP

If after all your hard work customizing the Ribbon to make it just so, do you now have to repeat everything on your other PCs? Nope. In the Customize Ribbon tab of the Excel Options dialog box, click Import/Export, click Export All Customizations, enter the customization filename, then click Save. On your other PC, display the Customize Ribbon tab of the Excel Options dialog box, click Import/Export, click Import All Customizations, select your saved customization file, and then click Open.

Using Office Add-ins

Excel supports the use of Office Add-ins to help you build your worksheets. *Office Add-ins* are small application programs that run within specific Office programs, such as Excel, and increase functionality to promote greater productivity.

There are Office Add-ins to help you learn about Excel's features, look up words in the *Merriam-Webster* dictionary, and even enter dates into your worksheet by clicking them on a calendar. Many of the Office Add-ins for Excel are available free of charge, whereas others are offered for a trial period after which you may purchase them from the Office Store for a small price.

To use any of these Office Add-ins in Excel, you first need to install them by following these steps:

1. **On the Insert tab of the Ribbon, click My Add-ins (you may have to first click the Add-ins button).**

   Excel opens the Office Add-ins dialog box containing the My Add-ins and Store buttons, along with thumbnails of all the Office Add-ins already installed and ready to insert into the current Excel workbook (see Figure 2-11).

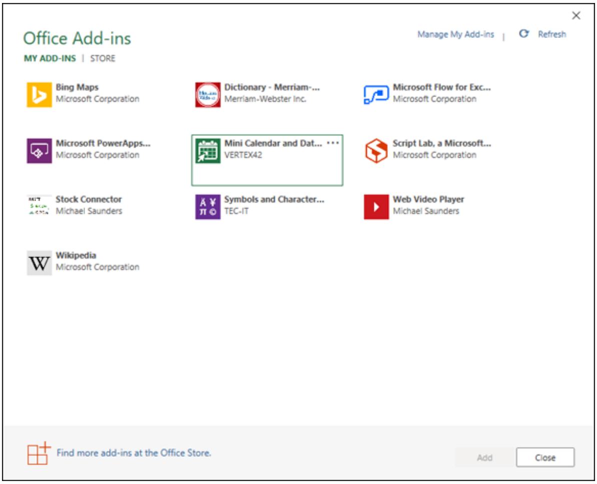

Office Add-ins
MY ADD-INS | STORE
Manage My Add-ins | Refresh
Bing Maps
Microsoft Corporation
Dictionary - Merriam-...
Merriam-Webster Inc.
Microsoft Flow for Exc...
Microsoft Corporation
Microsoft PowerApps...
Microsoft Corporation
Mini Calendar and Dat...
VERTEX42
Script Lab, a Microsoft...
Microsoft Corporation
Stock Connector
Michael Saunders
Symbols and Character...
TEC-IT
Web Video Player
Michael Saunders
Wikipedia
Microsoft Corporation
Find more add-ins at the Office Store.
Add
Close

FIGURE 2-11: Inserting the Excel Mini Calendar and Date Picker add-in into an Excel worksheet.

2. **To install new Office Add-ins, click the Store button.**

   Excel connects to the Office Store. Your Office Add-ins dialog box displays a list of add-ins for Excel along with a brief description of each add-in's functionality, its current rating by users (one to five stars), and price if it's not free (these usually have Free Trial Available) or May Require Additional Purchase alert if a limited version of the add-in is downloadable for free but a more complete and robust version requires a purchase. These add-ins are organized by categories ranging from All (the default) to Visualization that you can select in a column on the left side of the dialog box.

   To display more information about a particular add-in of interest, click its description. Excel then displays thumbnails of an Excel worksheet using the add-in, a more extensive description of its operation, a few sample reviews and stats on its current version, when it was first released, and whether or not the add-in can make changes to your worksheet and send data over the Internet.

3. **(Optional) To restrict the display of Office Add-ins to a particular category, such as Visualization, Document Review, or Editor's Picks, click its category in the column on the left side of the Office Add-ins dialog box.**
4. **When you find an add-in that you may want to install in any one of the categories, click its green Add button.**

   After you click the Add button for a free Office Add-in, Excel closes the Office Add-ins dialog box and downloads the add-in in the current worksheet for you to use while usually opening a taskbar for the new add-in in the current worksheet that enables you to start using it right away.

It also adds the Office Add-in to the list of installed Office Add-ins on the My Add-ins tab of the Office Add-ins dialog box. After initially installing an add-in, you can thereafter insert the Office Add-in you want to use into any open worksheet that you're working on by following these steps:

1. **If the Office Add-ins dialog box is not currently open in Excel, open it by clicking Insert, then the Add-ins button, if you see one, and then My Add-ins.**

   Excel displays all the Office Add-ins currently installed in Excel in the My Add-ins tab of the Office Add-ins dialog box.
2. **Click the Office Add-in you want to use in your worksheet to select it and then click the Add button or press Enter.**

   Excel then inserts the Office Add-in into your current worksheet so that you can start using its features.

Many Office Add-ins, such as *Merriam-Webster Dictionary* and Wikipedia, open in task panes docked on the right side of the worksheet window. Others, such as Bing Maps and the Mini Calendar, open as graphic objects that float above the worksheet.

To close Office Add-ins that open in docked task panes, you click the pane's Close button (X). To close Office Add-ins that open as floating graphic objects, you need to select the graphic and then press the Delete key (don't worry — doing this only closes the app without uninstalling it).

Note that after you start using Office Add-ins in Excel, they're added to the Recently Used Add-ins group of the My Add-ins button's drop-down menu. You can then quickly re-open any closed Office add-in that appears on this menu by clicking it.

TIP

If an Office Add-in you've installed doesn't appear on the My Add-in tab of the Office Add-ins dialog box, click the Refresh link to refresh the list. Use the Manage My Apps link in this dialog box to keep tabs on all the Office Add-ins you've installed for Office and SharePoint. If you want to delete an Office Add-in you're no longer using, right-click its icon on the My Add-ins tab and then click Remove on its pop-up menu.

Using Excel's Own Add-ins

Office Add-ins aren't the only ones that you can use to extend Excel's features. You can also use built-in add-ins created by Microsoft or add-ins that you can purchase from third-party vendors. Before you can use any Excel Add-in program, the add-in must be installed in the proper folder on your hard drive, and then you must click the add-in in the Add-Ins dialog box.

You can immediately use two different types of Excel Add-in programs to extend the features in Excel:

- **Excel Add-ins:** This group of add-ins (also known as automation add-ins) is designed to extend the data analysis capabilities of Excel. These include Analysis ToolPak, Euro Currency Tools, and Solver.
- **COM Add-ins:** COM (Component Object Model) add-ins are designed to extend Excel's capability to deal with and analyze

large amounts of data in data models (collections of related database tables). These include Microsoft Data Streamer for Excel, Microsoft Power Pivot for Excel, and Microsoft Power Map for Excel.

When you first install Excel, the add-in programs included with Excel are not loaded and therefore are not yet ready to use. To load any of these add-in programs, you follow these steps:

1. **Choose File ⇒ Excel Options (or press Alt + FTV) to open the Excel Options dialog box, and then click the Add-Ins tab.**

   The Add-Ins tab lists all the names, locations, and types of the add-ins to which you have access.

2. **(Optional) In the Manage drop-down list, Excel Add-Ins is selected by default. If you want to activate one or more of your COM add-ins, click COM Add-Ins from the Manage drop-down list.**

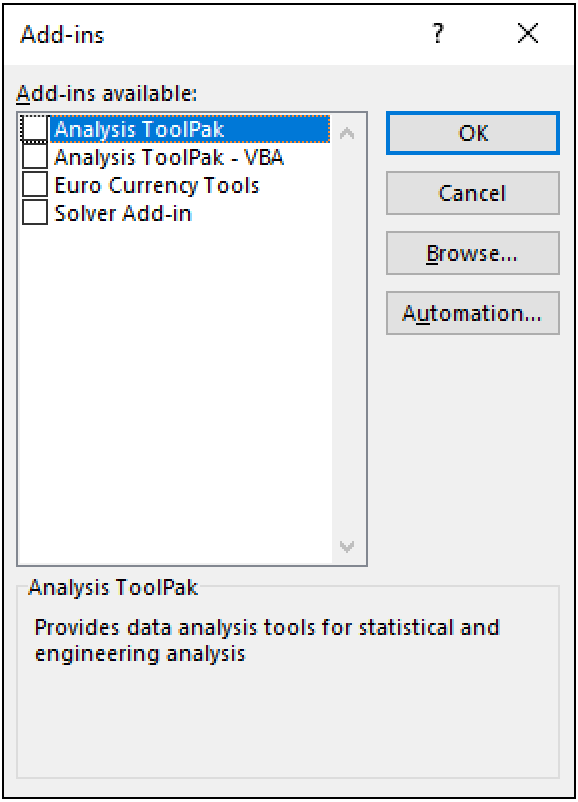
3. **Click the Go button.**

   If Excel Add-Ins was selected in the Manage drop-down list, Excel opens the Add-Ins dialog box (similar to the one shown in Figure 2-12), showing all the names of the built-in add-in programs you can load. If COM Add-Ins was clicked, the COM Add-Ins dialog box appears instead.

4. **Select the check box for each add-in program that you want loaded in the Add-Ins or COM Add-Ins dialog box.**

   Click the name of the add-in in the Add-Ins Available list to display a brief description of its function at the bottom of this dialog box.

5. **Click OK.**



☐ Analysis ToolPak
☐ Analysis ToolPak - VBA
☐ Euro Currency Tools
☐ Solver Add-in

Analysis ToolPak

Provides data analysis tools for statistical and engineering analysis

FIGURE 2-12: Activating built-in Excel Add-ins in the Add-Ins dialog box.

TIP

When you first install Excel, all four add-ins (Analysis ToolPak, Analysis ToolPak - VBA, Euro Currency Tools, and Solver Add-In) are available in the Add-Ins dialog box. (For more about these add-ins, see the following section, "Managing Excel Add-ins.") The tools in the two Analysis ToolPaks are added as special functions to the Function Library group and the Euro Currency tools to a Solutions group on the Formulas tab. The Solver add-in appears in the Analysis group on the Data tab.

Managing the standard Excel Add-ins

Whether you know it or not, you already have a group of Excel Add-in programs included when you install Excel:

- **Analysis ToolPak:** Adds a Data Analysis command to the Data tab, which gives you access to a set of sophisticated statistical analysis tools.
- **Analysis ToolPak - VBA:** Enables VBA programmers to publish their own financial, statistical, and engineering functions for Excel.
- **Euro Currency Tools:** Enables you to format worksheet values as euro currency and adds a EUROCONVERT function for converting other currencies into euros. To use these tools, click the Euro Conversion or Euro Formatting buttons that appear on the Ribbon in the Solutions group at the end of the Formulas tab.
- **Solver Add-In:** Calculates solutions to what-if scenarios based on cells that both adjust and constrain the range of values. (See Book 7, Chapter 1.) To use the Solver add-in, click the Solver button that appears on the Ribbon in the Analysis group at the end of the Data tab.

Managing Excel COM add-ins

The following COM add-in programs are included when you install Excel:

- **Microsoft Data Streamer for Excel:** Enables you to connect Excel to live, streaming data from sensor devices.
- **Microsoft Power Map for Excel**: Enables you to map geographic data on an interactive 3D globe. (See Book 7, Chapter 2.)
- **Microsoft Power Pivot for Excel:** Enables you to build complex data models using large amounts of data. It also facilitates data queries using DAX (Data Analysis Expressions) functions. (See Book 7, Chapter 2.)

REMEMBER You can readily manage your COM add-ins using the COM Add-Ins button in the Add-Ins group on the Developer tab. (To display the Developer tab in Excel, choose File ⇒ Options ⇒ Customize Ribbon [Alt+FTC], select the check box in front of Developer in the Main Tabs list box, then click OK.) When you click the COM Add-Ins button, Excel opens the COM Add-Ins dialog box that shows all the COM add-ins that are installed and activated. Here, you can activate and deactivate individual add-ins as needed.

Purchasing third-party add-ins

The add-ins included with Excel are not the only Excel Add-ins that you can lay your hands on. Many third-party vendors sell Excel Add-ins that you can often purchase online and then immediately download onto your hard drive.

To find third-party vendors and get information on their add-ins, open your web browser and search for *Excel Add-ins*.

Even before you do a web search, you may want to visit the Add-Ins.com website at `www.add-ins.com`.

This online outfit offers a wide variety of useful Excel Add-ins. One example is the Spreadsheet Assistant (its most popular Excel Add-in) that adds an Assistants tab to your Excel Ribbon with a whole lot of assistant command buttons designed to streamline working with Excel worksheets.

Note that you can expect to pay Add-Ins.com between $25 and $50 for add-in programs such as these (really reasonably priced if you consider how many hours it would take to split up names into separate cells in huge worksheets).

Book 2

Worksheet Design

Contents at a Glance

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Quick Printing the Worksheet

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Headers and Footers

Solving Page Break Problems

Printing the Formulas in a Report

Chapter 1

Building Worksheets

IN THIS CHAPTER

- **Creating a workbook from a template**
- **Designing a worksheet from scratch**
- **Understanding the different types of cell entries**
- **Knowing the different ways of entering data in the worksheet**
- **Using Data Validation to restrict the data entries in cells**
- **Linking your worksheet to other Excel workbooks, Office documents, and web pages**
- **Saving worksheets**

Before you start building a new worksheet in Excel, it helps to have an overall design in mind. Fortunately, the design aspect of worksheet-building is often the easiest part because you can borrow the design either from another workbook you've created or from a special workbook file — called a *template* — that provides you with the new worksheet's structure along with some predefined text and data.

After you've settled upon the design of your new worksheet, you're ready to begin entering its data. For your data entry chores, you can use several methods. This chapter not only covers all the methods for entering data — from the most basic to the most sophisticated — but also includes hints on when each method is the most appropriate. Note, however, that this chapter doesn't include information on building formulas, which is a major part of creating a new worksheet. Because formula-building is so extensive and so crucial to Excel success, I've devoted an entire book to it: see Book 3.

Creating Fresh Workbooks

When you launch Excel (without also opening an existing workbook file), the Start screen presents you with two choices for creating a new workbook:

- Open a new workbook (with the generic filename, Book1), consisting of a single, totally blank worksheet (with the generic worksheet name, Sheet1) by clicking the Blank Workbook template.
- Open a new workbook based on the design in one of the other templates displayed in the Start screen or available in the New screen (click the More Templates link or click the New button in the navigation pane).

If you select the Blank Workbook template, you can start laying out and building your new worksheet in the Sheet1 tab. If you select one of the other designed templates, you can start by customizing the workbook file's design as well as entering the data for your new worksheet.

Take it from a template

Spreadsheet templates are the way to go if you can find one that uses the design of the worksheet that you want to build (or is close to it, anyway). There are many templates to choose from when you initially launch Excel and then click the New option in the navigation pane. (See Figure 1-1.) The templates displayed on the New screen run the gamut from budgets and schedules to profit and loss statements, invoices, sales reports, and calendars.

If none of the templates displayed on the New screen fit the bill, you can search for templates. This screen contains links to common suggested searches: Business, Personal, Planners and Trackers, Lists, Budgets, Charts, and Calendar. When you click one of these links, the New screen displays your choices in that particular category.

TIP

If the type of template you're looking for doesn't fit any of the categories listed in the Suggested Searches, you can run your own template search. Click the Search for Online Templates text box, type one or more keywords describing the type of template (such as **finance**), and then press Enter or click the Start Searching button (the magnifying glass icon). Excel displays the search results as shown in Figure 1-2, which displays the templates that Excel uncovers based on a search for **finance**.

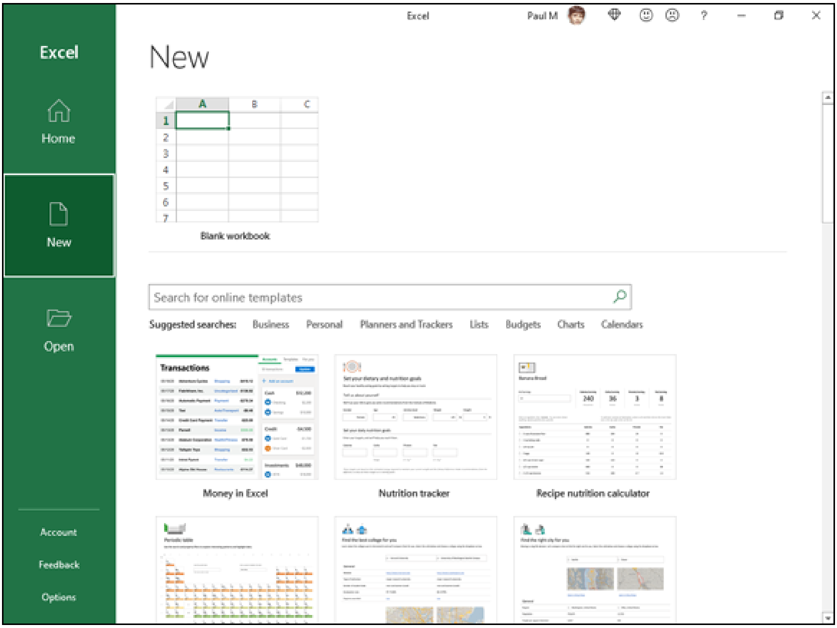

Excel
Paul M
Excel
Home
New
Open
Account
Feedback
Options
New
Blank workbook
Search for online templates
Suggested searches:
Business
Personal
Planners and Trackers
Lists
Budgets
Charts
Calendars
Transactions
Money in Excel
Nutrition tracker
Recipe nutrition calculator

FIGURE 1-1: The New screen is home to a fistful of templates you can use to get a head start on building a new workbook.

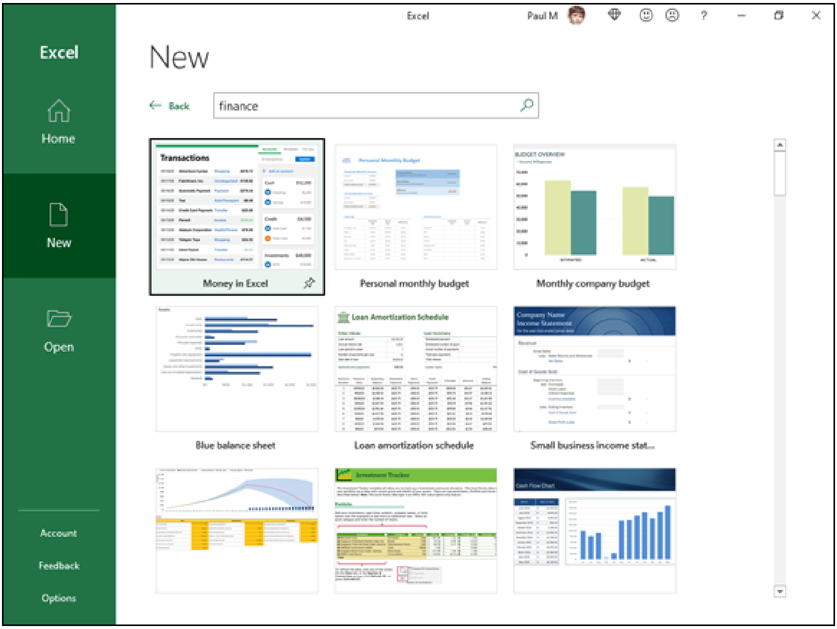
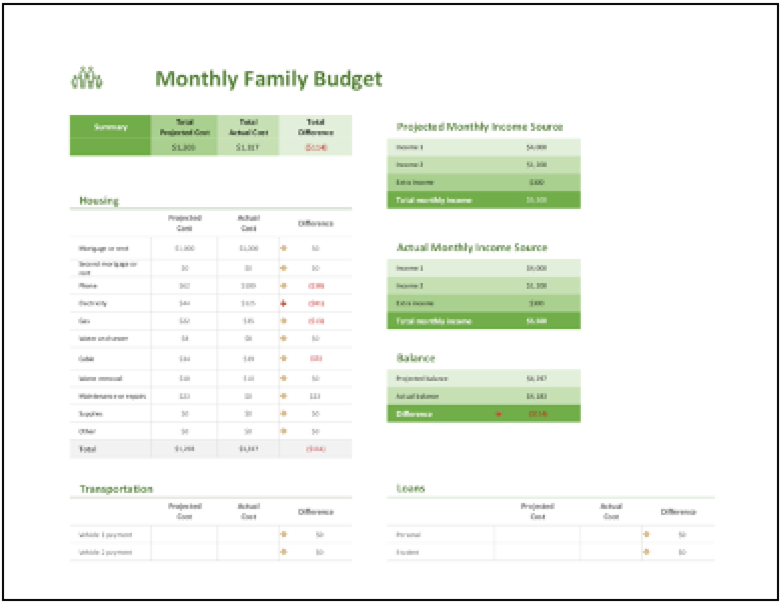

Excel
Paul M
Excel
Home
New
Open
Account
Feedback
Options
New
Back
finance
Money in Excel
Personal monthly budget
Monthly company budget
Blue balance sheet
Loan amortization schedule
Small business income stat...

FIGURE 1-2: Searching for finance-related templates.

REMEMBER Instead of using ready-made templates, you can create your own templates from your favorite Excel workbooks. After you save a copy of a workbook as a template file, Excel automatically generates a copy of the workbook whenever you open the template file. This way, you can safely customize the contents of the new workbook without any danger of inadvertently modifying the original template.

Downloading the template to use

When you locate a template with a design that you can adapt to your worksheet needs, you can download the template. Click the template's thumbnail on the New screen. Excel then opens a dialog box similar to the one shown in Figure 1-3, containing a more extensive description of the template and its download file size. To download the template and create a new Excel workbook from it, click the Create button. Excel creates the new workbook and gives it the same name as the template, but with a “1” tacked on to the end (for example, Family Budget Planner1).



Monthly Family Budget
Summary
Projected Monthly Income Source
Housing
Actual Monthly Income Source
Balance
Transportation
Loans

FIGURE 1-3: When you click a template thumbnail, Excel displays more details about the template.

If you return to the New screen (by choosing File ⇒ New or by pressing Alt+FN, you see the template you downloaded, as shown in Figure 1-4. You can click the downloaded template to create another new workbook based on that file (which will have a "2" tacked on to the filename).

To customize a worksheet generated from one of the installed templates, you replace the placeholder entries in the new worksheet with your own data. For strategies on entering your labels and values into the cells of a worksheet, see "Getting to Know Excel's Data Types" later in this chapter.

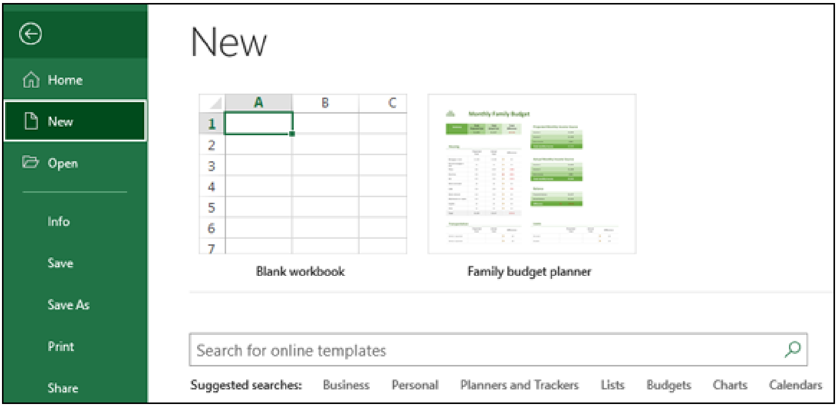

New
Home
New
Open
Info
Save
Save As
Print
Share
A
B
C
1
2
3
4
5
6
7
Blank workbook
Family budget planner
Search for online templates
Suggested searches:
Business
Personal
Planners and Trackers
Lists
Budgets
Charts
Calendars

FIGURE 1-4: The downloaded template now appears in the New screen.

Note that when filling in or replacing the data in a worksheet generated from one of these ready-made templates, you have access to all the cells in the worksheet: those that contain standard headings as well as those that require personalized data entry.

After you finish filling in the personalized data, save the workbook just as you would a workbook that you had created from scratch. (See the "Saving the Data" section at the end of this chapter for details on saving workbook files.)

Saving changes to your customized templates

You can save the customization you do to the templates you download to make the workbooks you create from them easier to use and quicker to fill out. To save your changes as a new template file, follow these steps:

1. **Choose File ⇒ Save As, or press Alt+FA.**

   The Save As screen opens where you select the location where the customized template file is to be saved.

2. **Select This PC.**

   Excel selects the Documents folder, which is the place you want to be.

   If you really want to store your personal templates elsewhere (say, on your OneDrive), you're free to do so. Just note that you'll have to jump through a few extra hoops to tell Excel where you store your custom templates. I show you how to navigate those hoops right after these steps. For now, just remember the location you select because you'll need it later.

3. **Use the Enter File Name Here text box to type the filename you want to use.**
4. **In the Save as Type list (which appears just below the Enter File Name Here text box), select Excel Template (*.xltx).**

   If you need your new template file to be compatible with earlier versions of Excel (versions 97 through 2003), click Excel 97–2003 Template (*.xlt) rather than Excel Template (*.xltx). When you do this, Excel saves the new template file in the older binary file format (rather than the newer XML file format) with the old `.xlt` filename extension instead of the newer `.xltx` filename extension. If your template contains macros that you want the user to be able to run when creating the worksheet, click Excel Macro-Enabled Template (*.xltm).

   If you're using the default Documents folder as the save location, Excel changes the selected folder to a subfolder of Documents named Custom Office Templates as soon as you change the file type from Excel Workbook to Excel Template.

5. **Click Save.**

   Excel saves your custom template in the location you selected.

   After the Save As dialog box closes, you still need to close the customized workbook file in the Excel work area.

6. **Choose File ⇒ Close, or press either Alt + FC or Ctrl + W to close the customized workbook file.**

If you saved your customized template file in any folder other than the one currently listed as the Default Personal Template Location in the Excel Options dialog box, you need to tell Excel about this folder and where it is by following these steps:

1. **Choose File ⇒ Options ⇒ Save (Alt+FTS).**

   Excel opens the Excel Options dialog box and selects the Save tab.

2. **Click the Default Personal Templates Location text box and enter the complete filename path for the folder where you saved your initial personal template file.**

   For example, if I created a Templates subfolder within the Documents folder on my personal OneDrive to store all my personal Excel template files, I'd enter the following pathname in the Default Personal Templates Location text box:

   ```
   C:\Users\Paul\OneDrive\Documents\Templates
   ```

3. **Click OK to put the new setting into effect.**

After designating the location of your personal templates folder as described in the preceding steps, the next time you open the New screen (choose File ⇒ New), you see two new headings below the Blank Workbook template (and above the Search box):

- **Office:** Click this heading to view and search for Office Excel templates.
- **Personal:** Click this heading to view your custom templates.

To generate a new workbook from one of your custom templates, click the Personal heading to display thumbnails for all the templates you've saved in the designated personal templates folder. To open a new Excel workbook from one of your custom templates, click the template's thumbnail.

Creating your own workbook templates

You certainly don't have to rely on workbook templates created by other people. Indeed, often you can’t do this because, even though other people may generate the type of template that you need, their design doesn’t incorporate and represent the data in the manner that you prefer or that your company or clients require.

When you can’t find a ready-made template that fits the bill or that you can easily customize to suit your needs, create your own templates from workbooks that you’ve created or that your company has on hand. The easiest way to create your own template is to first create an actual workbook prototype, complete with all the worksheets, text, data, formulas, graphics, and macros that it requires to function.

When readying the prototype workbook, make sure that you remove all headings, miscellaneous text, and numbers that are specific to the prototype and not generic enough to appear in the new template. You may also want to protect all generic data, including the formulas that calculate the values that you or your users input into the worksheets generated from the template and headings that never require editing. (See Book 4, Chapter 1 for information on how to protect certain parts of a worksheet from changes.)

After making sure that both the layout and content of the boilerplate data are hunky-dory, use the Save As command to save the workbook in the Excel Template (.xltx) file format in your personal templates folder so that you can then generate new workbooks from it. (For details on how to save a workbook as a template, refer to the steps in the previous section, “Saving changes to your customized templates.”)

As you may have noticed when looking through the sample templates included in Excel (refer to Figure 1-4, for example) or browsing through the templates that you can download from the Microsoft Office.com website found at `http://office.microsoft.com`, many worksheet templates hide the familiar worksheet grid of cells, preferring a look very close to that of a paper form instead. When converting a sample workbook into a template, you can also hide the grid, use cell borders to underscore or outline key groups of cells, and color different cell groups to make them stand out. (For information on how to do this kind of stuff, refer to Book 2, Chapter 2.)

REMEMBER You can add inline notes to parts of the template that instruct coworkers on how to properly fill in and save the data. These notes are helpful if your coworkers are unfamiliar with the template and may be less skilled in using Excel. (See Book 4, Chapter 3 for details about adding notes to worksheets.)

Designing a workbook from scratch

Not all worksheets come from templates. Often, you need to create unique worksheets that aren't intended to function as standard models from which certain types of workbooks are generated. In fact, most of the worksheets that you create in Excel may be of this kind, especially if your business doesn't rely on the use of highly standardized financial statements and forms.

Planning your workbook

When creating a new workbook from scratch, you need to start by considering the layout and design of the data. When doing this mental planning, you may want to ask yourself some of the following questions:

- How many worksheets do you need to handle the different components or aspects of the model you want to build?
- Does the layout of the worksheet require the use of data tables (with both column and row headings) or tables (with column headings only)?
- Do these data tables and tables need to be laid out on a single worksheet, or can they be placed in the same relative position on multiple worksheets of the workbook (like pages of a book)?
- Do the data tables in the workbook use the same type of formulas?
- Do some of the columns in the workbook tables get their input from formula calculations, or do they get their input from other tables (called *lookup tables*) in the workbook?
- Will any of the data in the workbook be graphed, and will these charts appear in the same worksheet (referred to as *embedded charts*), or will they appear on separate worksheets in the workbook (called *chart sheets*)?
- Does any of the data in the workbook come from worksheets in separate workbook files?
- How often will the data in the workbook be updated or added to?
- How much data will the workbook ultimately hold?
- Will the data in the workbook be shared primarily in printed or

online form?

All these questions are an attempt to get you to consider the basic purpose and function of the new workbook before you start building it, so that you can come up with a design that is both economical and fully functional.

Planning for economy

Economy is an important consideration because when you open a workbook, all its data is loaded into your computer's memory. This may not pose any problems if you're running Excel on one of the latest generation of PCs with more memory than you can conceive of using at one time. However, memory usage can pose quite a problem if you're running Excel on a small Windows tablet with a minimum of memory or on a smartphone with limited resources. Similarly, you may share the workbook file with someone whose device is not so well equipped as yours. Also, depending on just how much data you cram into the workbook, you may even come to see Excel creep and crawl the more you work with it.

To help guard against these problems, make sure that you don't pad the data tables and lists in your workbook with extra empty "spacer" cells. Keep the tables as close together as possible on the same worksheet (with no more than a single blank column or row as a separator, which you can adjust to make as wide or high as you like) or — if the design allows — keep them in the same region of consecutive worksheets.

Planning for functionality

Along with economy, you should pay attention to the functionality of the worksheet. This means that you need to allow for future growth when selecting the placement of its data tables, tables, and charts. This is especially important in the case of tables because they have a tendency to grow longer and longer as you continue to add data, requiring more and more rows of the same few columns in the worksheet. This means that you should usually consider all the rows of the columns used in a table as "off limits." In fact, always position charts and other supporting tables to the right of the list rather than somewhere below the last used row. This way, you can continue to add data to your list without ever having to stop and first move some unrelated element out of the way.

This spatial concern is not the same when placing a data table that will total the values both down the rows and across the columns table — for example, a sales table that sums your monthly sales by item with formulas that calculate monthly totals in the last row of the table and formulas that calculate item totals in the last column. In this table, you don’t worry about having to move other elements, such as embedded charts or other supporting or unrelated data tables, because you use Excel’s capability of expanding the rows and columns of the table from within. As the table expands or contracts, surrounding elements move in relation to and with the table expansion and contraction. You do this kind of editing to the table because inserting new table rows and columns ahead of the formulas ensures that they can be included in the totaling calculations. In this way, the row and column of formulas in the data table act as a boundary that floats with the expansion or contraction of its data but that keeps all other elements at bay.

Opening new blank workbooks

Although you can open a new workbook when you first start Excel, you'll often need to open a blank workbook after you've started working with Excel. The easiest way to open a blank workbook is to press Ctrl + N. Excel responds by opening a new workbook, which is given a generic Book name with the next unused number (Book2, if you opened Excel with a blank Book1). You can also do the same thing in Backstage view by clicking File ⇒ New and then selecting the Blank Workbook thumbnail.

As soon as you open a blank workbook, Excel makes its document window active. To then return to another workbook that you have open (which you would do if you wanted to copy and paste some of its data into one of the blank worksheets), move the mouse pointer over the Excel button on the Windows taskbar and then click the workbook thumbnail or press Alt + Tab until its file icon is selected in the dialog box that appears in the middle of the screen.

TIP If you ever open a blank workbook by mistake, you can just close it right away by pressing Ctrl + W, choosing File ⇒ Close, or pressing Alt + FC. Excel then closes its document window and automatically returns you to the workbook window that was originally open at the time you mistakenly opened the blank workbook.

Getting to Know Excel's Data Types

Before covering the many methods for getting data into the cells of your new worksheet, you need to understand which types of data you can enter. To Excel, everything that you enter in any worksheet cell is either one of two types of data: *text* (also known as a *label*) or a *number* (also known as a *value* or *numeric entry*). (When you enter a formula, as I describe in Book 3, the result that appears in the cell is either text or a number.)

The reason that you should care about what type of data you enter into your worksheet cells is that Excel treats your entry differently, depending on what type of data it thinks you've entered.

- **Text** entries are automatically left-aligned in their cells, and if they consist of more characters than fit within the column's current width, the extra characters spill over and are displayed in blank cells in columns on the right. (If these cells are not blank, Excel cuts off the display of any characters that don't fit within the cell borders until you widen its column.)
- **Numbers** are automatically right-aligned in their cells, and if they consist of more characters (including numbers and any formatting characters that you add) than fit within the column's current width, Excel displays a string of number signs across the cell (######), telling you to widen the column. (In some cases, such as decimal numbers, Excel truncates the decimal places shown in the cell instead of displaying the number-sign overflow indicators.)

So, now you need to know how Excel differentiates between text and numbers.

What's in a label?

Here's the deal with text entries:

- Excel treats all data entries beginning with a letter or a punctuation mark as text.
- Excel treats all data entries that mix letters (A–Z) and numbers as text, even when the entry begins with a number.
- Excel treats all data entries that mix numbers with punctuation other than commas (,), periods (.), and forward slashes (/) as text, even when they begin with a number.

So, in addition to letter-only entries, such as *First Quarter Earnings* and *John Smith,* many mixed data entries, including *C123, 666-45-0034,* and *123C,* are also considered text entries.

However, a problem exists with numbers that are separated by dashes (-): If the numbers separated by dashes correspond to a valid date, Excel converts the entry into a date (which, believe it or not, is a type of numeric entry — see the “Dates and times” section in this chapter for details). For example, if you enter *1-6-22* in a cell, Excel thinks that you want to enter the date January 6, 2022, in the cell, and the program automatically converts the entry into a date number (displayed as 1/6/2022 in the cell).

TIP If you want to enter a number as text in a cell, you can either format the cell as Text (see Book 2, Chapter 2) or preface its first digit with an apostrophe ('). For example, if you're entering a part number that consists of all numbers, such as 12-30-22, and you don't want Excel to convert it into the date December 30, 2022, you need to begin the entry with an apostrophe, like so:

```
'12-30-19
```

Likewise, if you want to enter 3/4 in a cell, meaning three out of four rather than the date March 4, you enter

```
'3/4
```

(Note that if you want to designate the fraction, three-fourths, you need to input =3/4, in which case Excel displays the value 0.75 in the cell display.)

When you complete an entry with an initial apostrophe that Excel would normally consider a value, such as the 12-30-22 date example, the apostrophe is not displayed in the cell. (The apostrophe does appear in the Formula bar and when you open the cell for editing.)

Suppose you enter a numeric value, preceded by an apostrophe, like so:

```
'12345
```

In this case, a tiny green triangle — the Excel error indicator — appears in the upper-left corner of the cell, and an alert symbol appears to the immediate left (as long as the active cell is in this cell). When you click this alert indicator, a menu similar to the one shown in Figure 1-5 appears. The “error” that Excel is alerting you to appears on the first line of the menu: Number Stored as Text, in this example. You can click the Convert command (Convert to Number, in this example) to convert the entry to a true number (by removing the apostrophe).

WARNING If you start a cell entry with the equal sign (=) followed by other characters that aren't part of a formula, Excel displays an error dialog box as soon as you try to complete the data entry. Excel uses the equal sign to indicate the use of a formula, and what you have entered is not a valid formula. The program knows that Lotus 1-2-3 used the @ symbol to indicate the use of a built-in function, and what you have entered is not a valid built-in function. This means that you must preface any data entry beginning with the equal sign and @ symbol that isn't a valid formula with an apostrophe to get it into the cell.

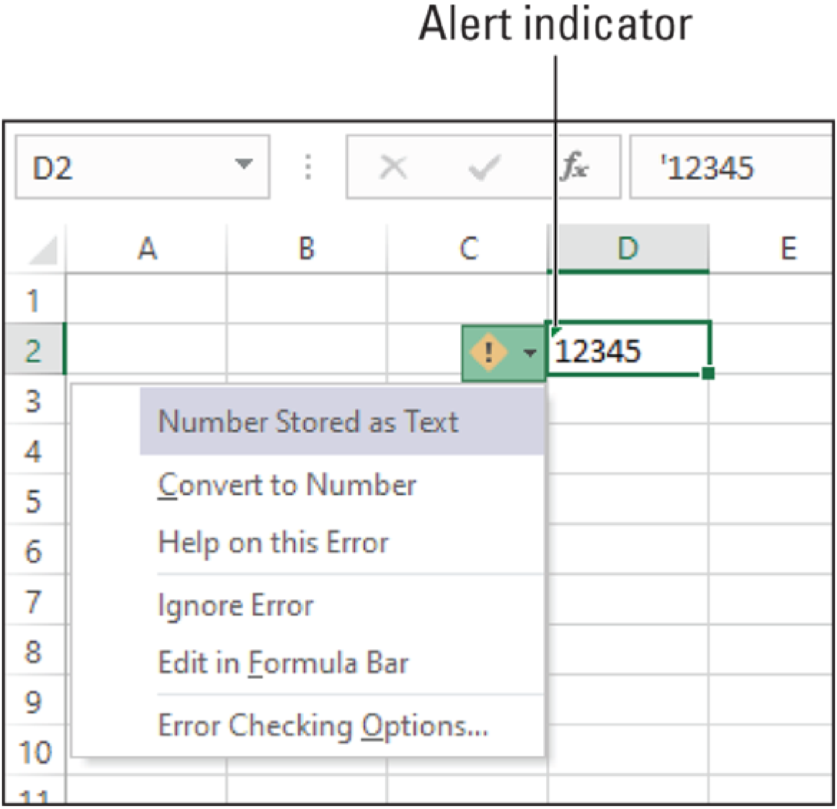

Alert indicator
D2
fx
'12345
A
B
C
D
E
1
2
3
4
5
6
7
8
9
10
11
12345
Number Stored as Text
Convert to Number
Help on this Error
Ignore Error
Edit in Formula Bar
Error Checking Options...

FIGURE 1-5: Click the alert indicator to open the menu attached to the Number Stored as Text alert.

What's the value?

Spreadsheets were developed to deal with financial records and calculations, which included plenty of extended item totals, subtotals, averages, percentages, and grand totals. This numeric focus is still true today, and in a typical worksheet, the numeric data entries often outnumber (pun very much intended) the text entries. Of course, you can create worksheets that are full of numbers that have nothing to do with debits, credits, income statements, invoices, quarterly sales, and dollars and cents. (And your Excel work will also certainly include worksheets where there are far more text entries than numeric entries, especially when you get into storing data in tables, as described in Book 6.)

Number entries that you make in your worksheet can be divided into three categories:

- **Numbers that you input** directly into a cell. (You can do this with the keyboard, your voice if you use the Speech Recognition feature, or even by handwriting if your PC is equipped with a writing tablet.)
- **Date and time numbers** that are also input directly into a cell but are automatically displayed with the default Date and Time number formats and are stored behind the scenes as special date serial and hour decimal numbers.
- **Numbers calculated by formulas** that you build yourself by using simple arithmetical operators and/or Excel's sophisticated built-in functions.

Inputting numbers

Numbers that you input directly into the cells of the worksheet can be positive or negative, integers, percentages, or decimal values. Numbers can represent a wide variety of values, including dollars and cents, widgets in stock, workers in the Human Resources department, or potential clients.

When inputting numbers, you can mix the digits 0–9 with the following characters:

```
– () + $ . , %
```

You use these characters in the numbers you input as follows:

- Preface the digits of the number with – or enclose them in a pair of parentheses to indicate that the number is a negative number, as in –53 or (53).
- Preface the digits of the number with a plus sign (+) when you want to explicitly designate the number as positive, as in +(53) to convert negative 53 into positive 53. Excel considers all numbers to be positive unless you designate them as negative.
- Preface the digits of the number with a dollar sign ($), as in $500, to format the cell with the Currency style format as you enter the number. (You can also apply this format before or after you enter the number.)
- Input a period (.) in the digits of the number to indicate the position of the decimal point in the number, as in 500.25. (Note that you don't have to bother entering trailing zeros after the decimal point because the General number format automatically drops them, even if you type them.)
- Input commas (,) between the digits of a number to indicate the position of thousands, hundred thousands, millions, billions, and the like, and to assign the Comma style number format to the cell, as in 642,153. (You can also have Excel add the commas by assigning the Comma format to the cell before or after you input the number.)
- Append the percent sign (%) to the digits of a number to convert the number into a percentage and assign the Percent number style to the cell, as in 12%.

The most important thing to remember about a number that you input is that how it appears depends on the type of number formatting currently assigned to the cell in which the number is entered. When you first open a blank workbook, the number format appropriately called General (which some have called the equivalent of no number formatting because it doesn't add any special format characters, such as a constant number of decimal places or thousands separators) is applied to each cell of the worksheet. You can override the General format by adding your own formatting characters as you input the number in a cell or, before or after you input the number, by selecting the cell and then assigning a different number format to it. (See Book 2, Chapter 2 for details.)

Dates and times

Excel stores dates and times that you input into a worksheet as special values. Dates are stored as serial numbers, and times are stored as decimal fractions. Excel supports two date systems: the 1900 date system used by Excel for Windows (also used by Lotus 1-2-3), which uses January 1, 1900, as serial number 1, and the 1904 system used by Excel for the Macintosh, which uses January 2, 1904, as serial number 1.

REMEMBER If you use Excel on a Windows PC or a Mac in your office, you can switch from the default 1900 date system to the 1904 date system for those worksheets that you create in the Windows version and then transfer to the Mac. To switch to the 1904 date system, click the Advanced tab of the Excel Options dialog box (File ⇒ Excel Options or Alt + FT) and then select the Use 1904 Date System check box in the When Calculating This Workbook section.

By storing dates as serial numbers representing the number of days that have elapsed from first system date (January 1, 1900, or January 2, 1904), Excel can perform arithmetic with dates. For example, you can find out how many days there are between February 15, 1949, and February 15, 2022, by entering 2/15/2022 in one cell and 2/15/1949 in the cell below, and then creating a formula in the cell below that one that subtracts the cell with 2/15/1949 from the one containing 2/15/2022. Because Excel stores the date 2/15/2022 as the serial number 44607 and the date 2/15/1949 as the serial number 17944, it can calculate the difference and return the result of 26663 (days, which is equal to 73 years).

TIP When you type a date directly into a formula that performs date arithmetic (as opposed to constructing a formula using references to cells that contain date entries), you must enclose the date in quotation marks. So, for example, if you type the dates in a formula that calculates the number of days between February 15, 1949, and February 15, 2022, in the cell you have to type the following formula:

```
="2/15/2022"-"2/15/1949"
```

Times of the day are stored as decimal numbers that represent the fraction of the 24-hour period starting with 0.0 for 12:00 midnight through 0.999 for 11:59:59 p.m. By storing times as decimal fractions, Excel enables you to perform time calculations such as those that return the elapsed time (in minutes) between any two times of the day.

Inputting dates and times using recognized formats

Although Excel stores dates as serial numbers and times as decimal fractions, luckily you don't have to use these numbers to enter dates or times of the day into cells of the worksheet. You enter dates by using any of the recognized Date number formats that are used by Excel, and you enter times by using any of the recognized Time number formats. Excel then assigns and stores the appropriate serial number or decimal fraction at the same time the program assigns the date or time format that you used for this value. Table 1-1 shows you typical date and time entries that you can use as examples when entering dates and times in the cells of a worksheet.

TABLE 1-1 Common Ways to Enter Dates and Times

What You Enter in the Cell	*Date or Time Recognized by Excel (As Displayed on the Formula Bar)*
1/6/2022	January 6, 2022
1/6/22	January 6, 2022
1-6-2022	January 6, 2022
6-Jan-2022	January 6, 2022
6-Jan	January 6, 2022 (assuming the current year is 2022)
Jan-16	January 2022 (assuming the current year is 2022)
1/6/2022 5:25	1/6/2022 5:25 a.m.
5:25	5:25:00 AM
5:25 P	5:25:00 PM
17:25	5:25:00 PM
17:25:33	5:25:33 PM

Understanding how Excel treats two-digit years

The only thing that's a tad bit tricky about inputting dates in a worksheet comes in knowing when you have to input all four digits of the year and when you can get away with entering only two. As Table 1-1 shows, if you input the date 1/6/22 in a cell, Excel recognizes the date as 1/6/2022 and not as 1/6/1922. In fact, if you enter the date January 6, 1922, in a worksheet, you must enter all four digits of the year (1922).

Here's how Excel decides whether a year for which you enter only the last two digits belongs to the 20th or 21st century:

- 00 through 29 belong to the 21st century, so Excel interprets 7/30/29 as July 30, 2029.
- 30 through 99 belong to the 20th century, so Excel interprets

7/30/30 as July 30, 1930.

This means that you don't have to enter the four digits of the year for dates in the years 2000 through 2029, or for dates in the years 1930 through 1999.

TIP If you can't remember these cutoffs and are just generally confused about when to enter two digits versus four digits, just go ahead and enter all four digits of the year. Excel never misunderstands which century the date belongs to when you spell out all four digits of the year.

Numeric formulas

Many numeric entries in a typical worksheet are not input directly but are returned as the result of a calculation by a formula. The numeric formulas that you build can do anything from simple arithmetic calculations to complex statistical analyses. (See Book 3 for complete coverage of all types of numeric formulas.) Most worksheet formulas use numbers that are input into other cells of the worksheet in their calculations. Because these formulas refer to the address of the cell containing the input number rather than the number itself, Excel can automatically recalculate the formula and return a new result whenever you change the values in the original cell.

The most important thing to remember about numeric formulas is that a cell that contains a formula displays the formula's result (its calculated value). If you make the cell active, the formula's contents (which indicate how the calculation is performed) are displayed on the Formula bar. A number returned by a formula is displayed using the nondescript General number format. To get this calculated number to appear the way you want in the worksheet, select the cell that contains the formula and apply a more appropriate number format to the cell. (See Book 2, Chapter 2 for details.)

Data Entry 101

I want to pass on a few basic rules of data entry:

- You must first select the cell where you want to make the data entry.

- Any entry that you make in a cell that already contains data replaces the existing entry.
- Every data entry that you make in a cell must be completed with some sort of action, such as clicking the Enter button on the Formula bar (pointed out in Figure 1-6; note that this button is only enabled when you're entering data); pressing the Enter key, the Tab key, or one of the arrow keys; or clicking a different cell.

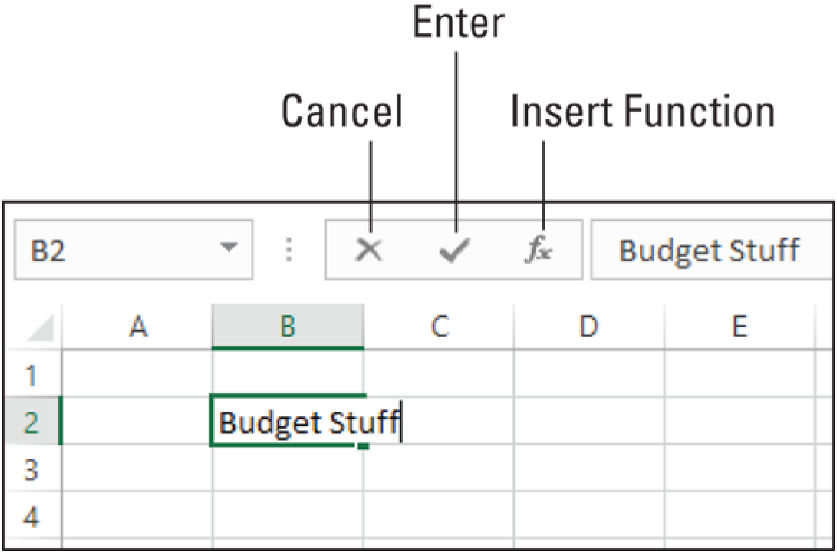


FIGURE 1-6: One way to complete a cell entry is to click the Enter button in the Formula bar.

The first rule sounds so obvious that it should go without saying, but you'd be surprised how many times you look at the cell where you intend to add new data and then just start entering that data without realizing that you haven't yet moved the active cell to that cell. As a result, the data entry that you're making is not destined to go into the cell that you intended. In fact, you're in the process of making the entry in whatever cell currently contains the active cell, and if that cell already contains data, you're in the process of replacing its entry with the one you meant to go somewhere else!

REMEMBER This is why the third rule is so important: Even if you're in the process of messing up your worksheet by entering data in the wrong cell (and, if that cell has data, by also destroying a perfectly good entry), you haven’t messed anything up until you complete the entry (by, for example, pressing Enter). That reprieve means you can avoid the data entry error by clicking the Cancel button on the Formula bar (see Figure 1-6) or by pressing Escape. The erroneous data entry then disappears from the Formula bar (and the original data entry — if it exists — remains intact), and you’re then free to move the active cell to the desired cell and redo the entry there.

Data entry keyboard style

The only trick to entering data from the keyboard is to figure out the most efficient way to complete the entry in the active cell (and Excel gives you many choices in this regard).

One possibility is to complete any data entry by pressing the Enter key. Pressing Enter not only completes the entry in the cell, but also moves the active cell down to the cell in the next row. Pressing the Enter key is the efficient choice when you’re entering data in a single column because it means that Excel automatically selects the cell in the next row for you. Sweet!

Another way to move the active cell down is to complete the cell entry by pressing the ↓ key. Note, however, that this only works for new entries, not when you're editing an existing entry.

A third possibility is to press the → key. Pressing → both completes the entry and moves the active cell to the next cell to the right. (Again, this only works for new entries.) Pressing → is the efficient option when you want to enter the data in a single row because it means that Excel automatically selects the cell in the next column for you. Thanks! (To be nerdily complete here, note that you can achieve the same effect by pressing the Tab key.)

Take a look at Table 1-2 to get an idea of the keys that you commonly use to complete data entries. Keep in mind, however, that any key combination that moves the active cell (see Table 1-1 in Book 1, Chapter 1, for a review of these keystrokes) also completes the data entry that you’re making, as does clicking another cell in the worksheet.

TABLE 1-2 Keys Used in Completing Data Entry

Press	***To Have the Cell Pointer Move***
Enter	Down one row
↓	Down one row

→	Right one column
Tab	Right one column
Shift+Tab	Left one column
←	Left one column
Shift+Enter	Up one row
↑	Up one row

TIP What if you want to complete the data entry and stay in the same cell? Alas, you can't do that from the keyboard. Instead, you need to click the Enter button on the Formula bar (presumably this is what Microsoft intended; otherwise, why have the button?). Clicking Enter leaves the active cell on the cell in which you entered the data. Clicking Enter is the efficient move when you want to keep working on the same cell, say, by applying some text or numeric formatting. However, clicking Enter is not at all efficient when the mouse pointer isn’t close to it or when you prefer to move the active cell to a different cell for your next entry.

TIP If you have more than one cell selected (see Book 2, Chapter 2 for more on this) and then press Ctrl+Enter to complete the data entry that you’re making in the active cell of this selected range, Excel simultaneously enters that data entry into all the cells in the selection. You can use this technique to enter a single label, value, or formula in many places in a worksheet at one time.

If you have more than one worksheet selected (see Book 2, Chapter 4) at the time that you make an entry in the active cell, Excel makes that entry in the corresponding cells of all the selected worksheets. For example, if you enter the heading *Wild Budget Guesses* in cell C3 of Sheet1 when Sheet1 through Sheet3 are selected, Excel enters *Wild Budget Guesses* in cell C3 of Sheet2 and Sheet3 as well.

Doing data entry with the Touch keyboard

TIP

If you’re running Excel on a touchscreen device that lacks a physical keyboard, you need to open the Windows Touch keyboard and use it to input your worksheet data. To open the Touch keyboard, tap the Touch Keyboard button on the right side of the Windows taskbar (see Figure 1-7; this is the Windows 10 touch keyboard; the Windows 11 version is slightly different). Windows displays the standard Touch keyboard docked at the bottom of the Excel program window.

To undock the standard Touch keyboard beneath the Excel program window or select one of the other styles of Touch keyboard, tap the Keyboard Settings button (see Figure 1-7) and then tap the Float Keyboard button (also pointed out in Figure 1-7). Figure 1-7 shows you how your touchscreen looks after undocking the Windows standard Touch keyboard and dragging it up away from the Excel Status bar.

As shown in this figure, when undocked, the Windows standard Touch keyboard remains completely separate from the Excel program window so that you can reposition it to access most of the cells in the current worksheet when doing your data entry. The standard Touch keyboard is limited mostly to letter keys above a spacebar with a few punctuation symbols (apostrophe, comma, period, and question mark). This standard keyboard also sports the following special keys:

- **Backspace** (pointed out in Figure 1-7): Deletes the character to the immediate left of the insertion point cursor when entering or editing a cell entry. When a cell is selected (but you're not entering or editing data in that cell), tapping Backspace deletes the entire cell entry.

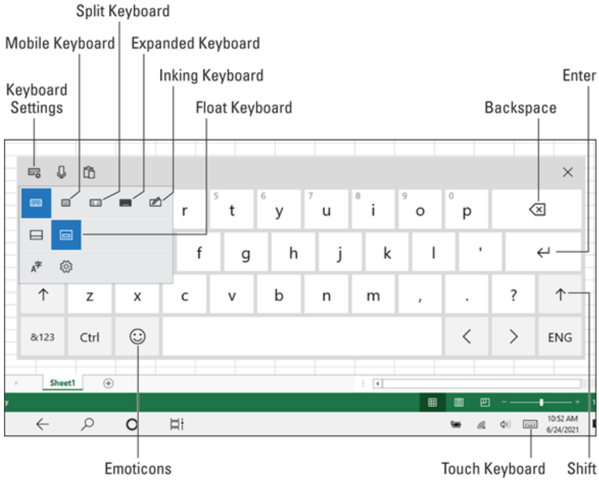

Split Keyboard
Mobile Keyboard
Expanded Keyboard
Inking Keyboard
Keyboard Settings
Float Keyboard
Enter
Backspace
Emoticons
Touch Keyboard
Shift

FIGURE 1-7: A Windows touchscreen after displaying and undocking the standard Touch keyboard so it floats in the middle of the Excel program window.

- **Enter** (see Figure 1-7): Completes an entry in the active cell and moves the cursor down one row in the same column.
- **Shift** (see Figure 1-7): Toggles the letter keys between uppercase and lowercase.
- **Numeric (&123):** Displays the numeric keypad, the Tab key, and several punctuation keys. (Tap the &123 key again to return to the standard QWERTY letter arrangement.)
- **Ctrl:** Enables you to enter Excel keyboard shortcuts that include Ctrl, such as Ctrl+C (copy), Ctrl+V (paste), and Ctrl+S (save). Tap Ctrl and then tap the other key in the key combo you want to perform.
- **Emoticons:** Displays a bunch of emoticons that you can enter into a cell entry. Tap the ABC key to return to the standard QWERTY keyboard.
- **Left (<):** Moves the active cell one cell to the left and completes any cell entry in progress.
- **Right (>):** Moves the active cell one cell to the right and completes any cell entry in progress.

TIP Windows also supports a much smaller version (called a mobile Touch keyboard) of the standard Touch keyboard. This is ideal when running Excel on a smaller tablet. To switch from the standard to the mobile Touch keyboard, tap the Keyboard Settings button followed by the Mobile Keyboard button (see Figure 1-7).

If you want to have access to a fully functional Touch keyboard when working in Excel, you need to switch to the expanded Touch keyboard by tapping the Keyboard Settings button followed by the Expanded Keyboard button (pointed out in Figure 1-7). The expanded version of the Windows Touch keyboard includes these special keys in addition all to those listed earlier for the standard Touch keyboard:

- **Esc:** Abandons incorrect cell entries and closes dialog boxes without making any changes.
- **Tab:** Moves the active cell one cell to the right like the → key.
- **Caps:** Turns on Caps Lock, which changes all the letter keys to uppercase and leaves them in that state so that you can make a cell entry that requires an extended run of uppercase letters. When you're done, tap Caps again to return the letter keys to lowercase.
- **Del:** Deletes the character to the immediate right of the insertion point cursor when entering or editing a cell entry. When a cell is selected (but you're not entering or editing data in that cell), tapping Delete clears the entire cell entry.
- **Windows:** Opens the Windows Start screen.
- **Fn:** Replaces the top row of numbers, as well as the minus and equals keys, with the function keys F1 through F12.
- **Alt:** Enables you to enter Excel keyboard shortcuts that include Alt, such as Alt+FT (Excel Options) and Alt+HX (cut). Tap Alt and then tap each of the other keys in the key combination.
- **Up:** Moves the active cell one row up in the current column.
- **Down:** Moves the active cell one row down in the current column.

Windows supports a split-keyboard arrangement of the Touch keyboard that enables you to see more of the cells in your worksheet as you enter your text and numbers in the worksheet from the separated banks of keys on the left and right side of the worksheet area. To switch to this arrangement, tap the Keyboard Settings button followed by the Split Keyboard button (see Figure 1-7). Excel then displays the split keyboard with the QWERTY letter keys separated into a left and right bank.

You can also switch to an Inking keyboard (pointed out in Figure 1-7) where you can make cell entries by writing your entries in the keyboard area with your finger, stylus, or digital pen and then inserting them into the worksheet by tapping its Insert button.

TIP If you've enabled Windows speech services on your device, you can just dictate your entry for the active cell in your worksheet. You do this by tapping the Microphone button (to the immediate right of the Keyboard Settings button in whatever style of touch keyboard you're using) and then dictate the text or value you wanted entered when the Listening prompt appears. Excel then enters what you dictated into the current worksheet cell when you pause and promptly turns the microphone off.

When you finish entering your worksheet data with your Windows Touch keyboard, you can close it and return to the normal full screen view of the Excel program window by tapping the Close button (X).

You AutoComplete me

Excel automatically makes use of a feature called AutoComplete, which attempts to automatically complete textual data entries (that is, entries that don't mix text and numbers). AutoComplete works this way: If you start a new text entry that begins with the same letter or letters as an entry that you've made recently in the same region of the worksheet, Excel completes the new text entry with the characters from the previous text entry that began with those letters.

For example, if you type the worksheet title *Sales Invoice* in cell A1 of a new worksheet and then, after completing the entry by pressing Enter, start entering the table title *Summary* in cell A2, as soon as you type *S* in cell A2, Excel completes the new text entry so that it also states *Sales Invoice* by adding the letters *ales Invoice.*

When the AutoComplete feature completes the new text entry, the letters that it adds to the initial letter or letters that you type are automatically selected (indicated by highlighting). This way, if you don't want to repeat the original text entry in the new cell, you can replace the characters that Excel adds just by typing the next letter in the new (and different) entry. In the previous example, in which Sales Invoice was repeated in the cell where you want to input *Summary,* the *ales Invoice* text appended to the *S* that you type disappears the moment you type *u* in *Summary.*

Note that when you have two different entries that begin with the same first letter but have different second letters, typing the second letter of one entry causes Excel to complete the typing of that entry, leaving you free to insert its text in the cell by pressing the Enter key or using any of the other methods for completing a cell entry.

To make use of automatic text completion rather than override it as in the previous example, complete the cell entry in your preferred way (that is, by pressing a key — such as Enter, Tab, or an arrow —), clicking the Enter button on the Formula bar, or clicking another cell). For example, say you're building a sales table in which you're inputting sales for three different account representatives — George, Jean, and Alice. After entering each name manually in the appropriate row of the Account Representative column, you need to type in only their first initial (*G* to get George, *J* to get Jean, and *A* to get Alice) in subsequent cells and then press the ↓ or Enter key to move down to the next row of that column. In a case like this, AutoComplete is more like automatic typing, and it makes filling in the Account Representative names for this table extremely quick and easy.

TIP

If the AutoComplete feature starts to bug you when building a particular worksheet, you can temporarily turn it off. Open the Excel Options dialog box (File ⇒ Options or Alt + FTA); click the Advanced tab, and then deselect the Enable AutoComplete for Cell Values check box in the Editing Options section. Note that disabling AutoComplete in this manner also disables the Flash Fill feature as well. (See "Flash Fill to the rescue" later in this chapter for details.)

You AutoCorrect me

Along with AutoComplete, Excel has an AutoCorrect feature that automatically fixes certain typos that you make in the text entries as soon as you complete them. For example, if you forget to capitalize a day of the week, AutoCorrect does this for you (turning *friday* into *Friday* in a cell as soon as you complete the entry). Likewise, if you mistakenly enter a word with two initial capital letters, AutoCorrect automatically lowercases the second capital letter (so that *QUarter* typed into a cell becomes *Quarter* upon completion of the cell entry).

In addition to these types of obvious capitalization errors, AutoCorrect also automatically takes care of common typos, such as changing *reserach* to *research* (an obvious transposition of two letters) or *percentof* to *percent of* (an obvious case of a missing space between letters). In addition to the errors already recognized by AutoCorrect, you can add your own common typos to the list of automatic replacements. Here's how:

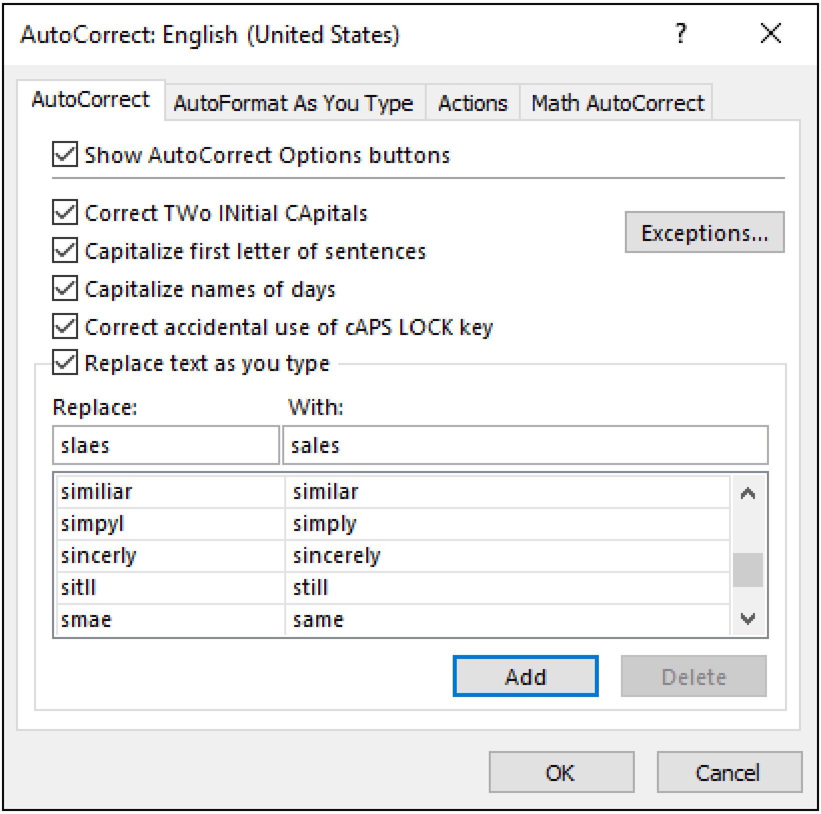
1. **Choose File ⇒ Options and then click the Proofing tab (Alt+FTP) followed by the AutoCorrect Options button.**

   The AutoCorrect dialog box opens for your language, such as English (U.S.), as shown in Figure 1-8.

2. **If the AutoCorrect options aren't already displayed in the dialog box, click the AutoCorrect tab to display them.**
3. **Click the Replace text box and then enter the typo exactly as you usually make it.**
4. **Click the With text box and enter the replacement that AutoCorrect should make (with no typos in it, please!).**

   Check the typo that you've entered in the Replace text box and the replacement that you've entered in the With text box.

5. **Click the Add button to add your new AutoCorrect replacement to the list of automated replacements.**
6. **Click OK.**


AutoCorrect: English (United States)
?
AutoCorrect
AutoFormat As You Type
Actions
Math AutoCorrect
Exceptions...
Add
Delete
OK
Cancel

☑ Show AutoCorrect Options buttons

☑ Correct TWo INitial CApitals
☑ Capitalize first letter of sentences
☑ Capitalize names of days
☑ Correct accidental use of cAPS LOCK key
☑ Replace text as you type

Replace:	With:
slaes	sales
similiar	similar
simpyl	simply
sincerly	sincerely
sitll	still
smae	same

FIGURE 1-8: You can add your own automated replacements to the AutoCorrect tab.

TIP

You can use the AutoCorrect feature to automatically replace favorite abbreviations with full text, as well as to clean up all your personal typing gaffes. For example, if you have a client with the name Great Lakes Securities, and you enter this client's name in countless worksheets that you create, you can make an AutoCorrect entry so that Excel automatically replaces the abbreviation *gls* with *Great Lakes Securities*. After you use AutoCorrect to enter Great Lakes Securities in your first cell by typing *gls,* the AutoComplete feature kicks in, so the next time you type the *g* of *gls* to enter the client's name in another cell on the same column, it fills in the rest of the name, leaving you with nothing to do but complete the entry.

REMEMBER AutoCorrect is not a replacement for Excel's spelling checker. You should still spell check your worksheet before sending it because the spelling checker finds all those uncommon typos that haven't been automatically corrected for you. (See Book 2, Chapter 3 for details.)

Constraining data entry to a cell range

One of the most efficient ways to enter data into a new table in your worksheet is to preselect the empty cells where the data entries need to be made and then enter the data into the selected range. This trick only works if you know ahead of time how many columns and rows the new table requires.

The reason that preselecting the cells works so well is that doing this constrains the active cell to that range, provided that you press *only* the keystrokes shown in Table 1-3. This means that if you're using the Enter key to move down the column as you enter data, Excel automatically positions the active cell at the beginning of the next column as soon as you complete the last entry in that column. Likewise, when using the Tab key to move the active cell across a row as you enter data, Excel automatically positions the active cell at the beginning of the next row in the table as soon as you complete the last entry in that row.

TABLE 1-3 Keystrokes for Moving Within a Selection

Press	*Moves the Cell Pointer*
Enter	Down one cell in the selection (moves one cell to the right when the selection consists of a single row)
Shift+Enter	Up one cell in the selection (moves one cell to the left when the selection consists of a single row)
Tab	One cell to the right in the selection (moves one cell down when the selection consists of a single column)
Shift+Tab	One cell to the left in the selection (moves one cell up when the selection consists of a single column)
Ctrl+period (.)	From corner to corner of the cell selection

Now you don't have to worry about repositioning the active cell at all when entering the table data; you can keep your attention on the printed copy from which you're taking the data.

TIP You can't very well use this preselection method on tables because they're usually open-ended affairs to which you continually append new rows of data. The most efficient way to add new data to a new or existing table is to format it as a table. (See Book 2, Chapter 2.)

Getting Excel to put in the decimal point

If your keyboard has a ten-key entry pad, you'll want to use it rather than the numbers on the top row of the keyboard to make your numeric entries in the worksheet. (Make sure that the Num Lock key is engaged, or you'll end up moving the active cell rather than entering numbers.) If you have a lot of decimal numbers (suppose that you're building a financial worksheet with loads of dollars and cents entries), you may also want to use Excel's Fixed Decimal Places feature so that Excel places a decimal point in all the numbers that you enter in the worksheet.

To turn on this feature, choose File ⇒ Options to open the Excel Options dialog box and then click the Advanced tab (or press Alt+FTA). Select the Automatically Insert a Decimal Point check box in the Editing Options section. You can then use the Places text box to specify the number of decimal places (2 is the default) that you want Excel to add to each number entry.

After turning on the Automatically Insert a Decimal Point option, Excel adds a decimal point to the number of places that you specified to every numeric data entry that you make at the time you complete its entry. For example, if you type the digits 56789 in a cell, Excel changes this to 567.89 when you complete the entry.

Note that when this feature is turned on and you want to enter a number without a decimal point, you need to type a period at the end of the value. For example, if you want to enter the number 56789 in a cell and *not* have Excel change it to 567.89, you need to type

```
56789.
```

You AutoFill me

Few Excel features are more helpful than the AutoFill feature, which enables you to fill in a series of entries in a row or column — all by entering only the first item (or, in some cases, the first two or three items) in the series. You can sometimes use the AutoFill feature to quickly input row and column headings for a new data table or to number the records in a table. For example, when you need a row of column headings that list the 12 months for a sales table, you can enter *January* or *Jan.* in the first column and then have AutoFill input the other 11 months for you in the cells in columns to the right. Likewise, when you need to create a column of row headings at the start of a table with successive part numbers that start at L505-120 and proceed to L505-128, you enter L505-120 in the first row and then use AutoFill to copy the part numbers down to L505-128 in the cells below.

The key to using AutoFill is the Fill handle, which is the small black square that appears in the lower-right corner of whatever cell contains the active cell. When you position the mouse or Touch pointer on the Fill handle, it changes from the normal thick, white-cross pointer to a thin, black-cross pointer. This change in shape is your signal that when you drag the Fill handle in a single direction, either down or to the right, Excel either copies the active cell entry to all the cells that you select or uses it as the first entry in a consecutive series, whose successive entries are then automatically entered in the selected cells.

Note that you can immediately tell whether Excel copied the cell entry or used it as the first in a series to fill in by the ScreenTips that appear to the right of the mouse pointer. As you drag through subsequent cells, the ScreenTip indicates which entry will be made if you release the mouse button (or remove your finger or stylus from a touchscreen) at that point. If the ScreenTip shows the same entry as you drag, you know Excel didn't recognize the entry as part of a consecutive series and is copying the entry verbatim. If, instead, the ScreenTips continue to change as you drag through cells showing you successive entries for the series, you know that Excel has recognized the original entry as part of a consecutive series.

Figures 1-9 and 1-10 illustrate how AutoFill works. In Figure 1-9, I entered January as the first column heading in cell B2 (using the Enter button on the Formula bar to keep the active cell in B2, ready for AutoFill). Next, I positioned the mouse pointer on the AutoFill handle in the lower-right corner of B2, then I dragged the Fill handle to the right until I reached cell M2 (and the ScreenTip stated December).

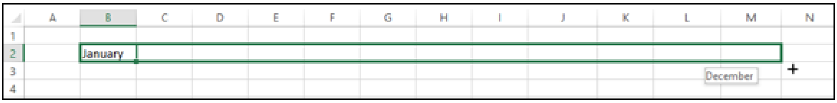
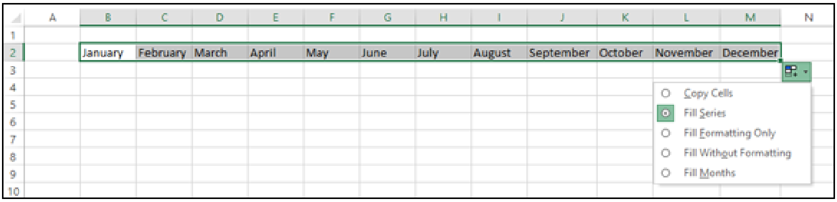


FIGURE 1-9: Dragging the Fill handle to fill in a series with the twelve months of the year.

Figure 1-10 shows the series that was entered in the cell range B2:M2 when I released the mouse button with cell M2 selected. For this figure, I also clicked the drop-down button attached to the Auto Fill Options button that automatically appears whenever you use the Fill handle to copy entries or fill in a series to show you the items on this drop-down menu. This menu contains a Copy Cells option button that enables you to override Excel's decision to fill in the series and have it copy the original entry (January, in this case) to all the selected cells.

Note that you can also override Excel's natural decision to fill in a series or copy an entry before you drag the Fill handle. To do so, hold down the Ctrl key (which adds a tiny plus sign to the upper-right corner of the Fill handle). Continue to hold down the Ctrl key as you drag the Fill handle and notice that the ScreenTip now shows that Excel is no longer filling in the series, but copying the entry as expected.



	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1														
2		January	February	March	April	May	June	July	August	September	October	November	December	

FIGURE 1-10: The series of monthly column headings with the AutoFill Options drop-down menu.

TIP

When you need to consecutively number the cells in a range, use the Ctrl key to override Excel's natural tendency to copy the number to all the cells you select. For example, if you want to number rows of a list, enter the starting number (1 or 100, it doesn't matter) in the first row and then press Ctrl to have Excel fill in the rest of the numbers for successive rows in the list (2, 3, 4, and the like, or 102, 103, 104, and so on). If you forget to hold down the Ctrl key and end up with a whole range of cells with the same starting number, click the Auto Fill Options drop-down button and then click the Fill Series option button to rectify the mistake by converting the copied numbers to a consecutively numbered series.

REMEMBER You can also use AutoFill to copy an original formula across rows and down columns of data tables and lists. When you drag the Fill handle in a cell that contains a formula, Excel automatically adjusts its cell references to suit the new row or column position of each copy. (See Book 3, Chapter 1 for details on copying formulas with AutoFill.)

AutoFill on a Touchscreen

TIP To fill out a data series using your finger or stylus when using Excel on a touchscreen tablet without access to a mouse or touchpad, you use the AutoFill button that appears on the touchscreen mini-toolbar as follows:

1. **Tap the cell containing the initial value in the series you want AutoFill to extend.**

   Excel selects the cell and displays selection handles (circles) in the upper-left and lower-right corners of the cell.

2. **Tap and hold the cell until the mini-toolbar appears.**

   When summoned by touch, the mini-toolbar appears as a single row of command buttons, Paste to AutoFill, terminated by a Show Context Menu button (with a black triangle pointing downward).

3. **Tap the AutoFill button on the mini-toolbar.**

   Excel closes the mini-toolbar and adds an AutoFill button to the currently selected cell (with a blue downward-pointing arrow in the square).

4. **Drag the AutoFill button through the blank cells in the same column or row into which the data**

series sequence is to be filled.

When you release your finger or stylus after selecting the last blank cell to be filled, Excel fills out the data series in the selected range.

AutoFill via the Fill button on the Ribbon

Instead of using the Fill handle or AutoFill button on the mini-toolbar, you can also fill in a series using the Fill button on the Excel Ribbon. To use the Fill button on the Home tab of the Ribbon to accomplish your AutoFill operations, follow these steps:

1. **Enter the first entry (or entries) upon which the series is to be based in the first cell(s) to hold the new data series in your worksheet.**
2. **Select the cell range where the series is to be created, across a row or down a column, being sure to include the cell with the initial entry or entries in this range.**
3. **Click the Fill button on the Home tab and then tap Series on its drop-down menu.**

   The Fill button is located in the Editing group right below the AutoSum button (the one with the Greek sigma). When you click the Series option, Excel opens the Series dialog box.
4. **Click the AutoFill option button in the Type column followed by the OK button in the Series dialog box.**

   Excel enters a series of data based on the initial value(s) in your selected cell range just as though you'd selected the range with the fill handle.

Note that the Series dialog box contains a bunch of options that you can use to further refine and control the data series that Excel creates. In a linear data series, if you want the series to increment more than one step value at a time, you can increase it in the Step Value text box. Likewise, if you want your linear or AutoFill series to stop when it reaches a particular value, you enter that into the Stop Value text box.

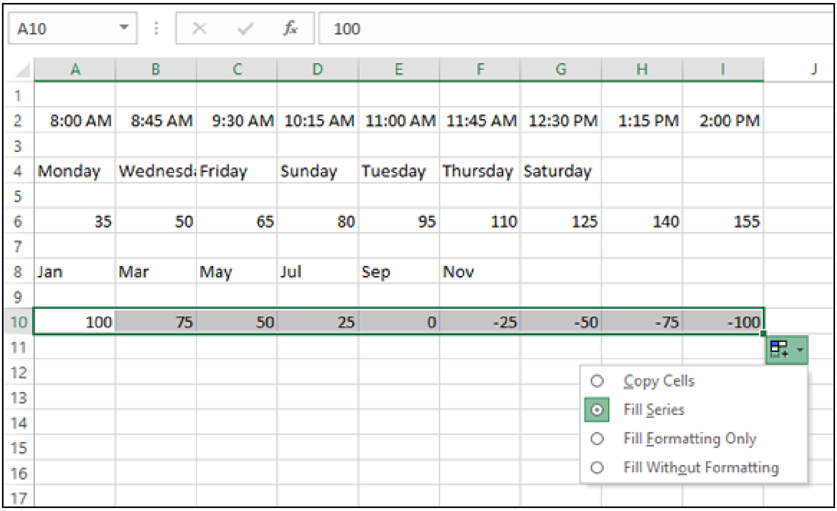
REMEMBER When you’re entering a series of dates with AutoFill that increment on anything other than the day, remember the Date Unit options in the Series dialog box enable you to specify other parts of the initial date to increment in the series. Your choices include Weekday, Month, or Year.

AutoFill series with custom increments

Normally, when you drag the Fill handle to fill in a series of data entries, Excel increases or decreases each entry in the series by a single unit (a day, month, hour, or whatever). You can, however, get AutoFill to fill in a series of data entries that uses a custom increment, such as every two days, every third month, or every hour-and-a-half.

Figure 1-11 illustrates several series all created with AutoFill that use custom increments:

- The first example in row 2 shows a series of times with 45-minute increments, starting with 8:00 a.m. in cell A3 and extending to 2:00 p.m. in cell I3.
- The second example in row 4 contains a series of weekdays with two-day increments, starting on Monday in cell A4 and extending to Saturday in cell G4.
- The third example in row 6 shows a series of numbers created with a custom increment of 15, starting with 35 in cell A6 and increasing to 155 in cell I6.
- The fourth example in row 8 shows a series of months created with a custom increment of 2, starting with Jan in cell A8 and ending with Nov in cell F8.
- The final example in row 10 shows a series of numbers created with a custom increment of -25 (so, really, a *decrement*), starting with 100 in cell A10 and decreasing to -100 in cell I10.



100

	A	B	C	D	E	F	G	H	I	J
1										
2	8:00 AM	8:45 AM	9:30 AM	10:15 AM	11:00 AM	11:45 AM	12:30 PM	1:15 PM	2:00 PM	
3										
4	Monday	Wednesd:	Friday	Sunday	Tuesday	Thursday	Saturday			
5										
6	35	50	65	80	95	110	125	140	155	
7										
8	Jan	Mar	May	Jul	Sep	Nov				
9										
10	100	75	50	25	0	-25	-50	-75	-100	
11										
12										
13										
14										
15										
16										
17										

○ Copy Cells
● Fill Series
○ Fill Formatting Only
○ Fill Without Formatting

FIGURE 1-11: Some series created with AutoFill by using custom increments.

To create a series that uses a custom increment, follow these four general steps:

1. **Enter the first two entries in the series in consecutive cells above one another in a column or side by side in a row.**

   Enter the entries one above the other when you intend to drag the Fill handle down the column to extend the series. Enter them side by side when you intend to drag the Fill handle to the right across the row.

2. **Position the cell pointer in the cell with the first entry in the series and drag through the second entry.**

   Both entries must be selected (indicated by being enclosed within the expanded active cell) before you use the Fill handle to extend the series. Excel analyzes the difference between the two entries and uses this difference as its increment in filling in the data series.

3. **Drag the Fill handle down the column or across**

the row to extend the series.

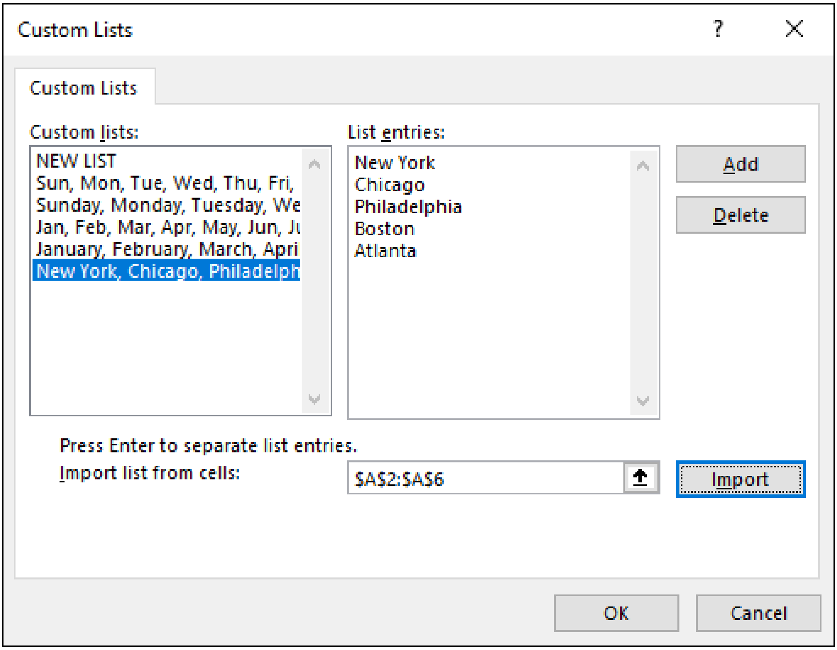
In this case, Excel fills the series by using the increment value. Check the ScreenTips to make sure that Excel is using the correct increment in filling out your data series.

4. **Release the mouse button when you reach the desired end of the series (indicated by the entry shown in the ScreenTip appearing next to the black-cross mouse pointer).**

Creating custom AutoFill lists

Just as you can use AutoFill to create a series with a custom increment, you can also cajole AutoFill into creating a custom list using items that you specify. For example, suppose that you often enter a standard series of city locations as the column or row headings in new worksheets. Instead of copying the list of cities from one workbook to another, you can create a custom list containing all the cities in the order in which they normally appear in your worksheets. After you create a custom list in Excel, you can then enter the first item in a cell and use the Fill handle to extend the series either down a column or across a row.

To create a custom series, you can either enter the list of entries in the custom series in successive cells of a worksheet before you open the Custom Lists dialog box, or you can type the sequence of entries for the custom series in the List Entries list box located on the right side of the Custom Lists tab in this dialog box, as shown in Figure 1-12.



Custom lists:

NEW LIST
Sun, Mon, Tue, Wed, Thu, Fri,
Sunday, Monday, Tuesday, We
Jan, Feb, Mar, Apr, May, Jun, Ju
January, February, March, Apri
New York, Chicago, Philadelph

List entries:

New York
Chicago
Philadelphia
Boston
Atlanta

Press Enter to separate list entries.

Import list from cells: $A$2:$A$6

FIGURE 1-12: Creating a custom list of cities for AutoFill.

If you already have the data series for your custom list entered in a range of cells somewhere in a worksheet, follow these steps to create the custom list:

1. **Click the cell with the first entry in the custom series and then drag the mouse or Touch pointer through the range until all the cells with entries are selected.**

   The expanded active cell should now include all the cells with entries for the custom list.

2. **Choose File ⇒ Options ⇒ Advanced (Alt + FTA) and then scroll down and click the Edit Custom Lists button located in the General section.**

   The Custom Lists dialog box opens with its Custom Lists tab, where you now should check the accuracy of the cell range listed in the Import List from Cells text box. (The range in this box lists the first cell and last cell in the current selected range separated by a colon — you can ignore the dollar signs following each part of the cell address.)

3. **Click the Import button to add the entries in the selected cell range to the List Entries box on the right and to the Custom Lists box on the left side of the Custom Lists tab.**

   Excel adds the data entries in the selected cell range to both the List Entries and the Custom Lists boxes.

4. **Click OK to close the Custom Lists dialog box, and then click OK to close the Excel Options dialog box.**

If you don't have the entries for your custom list entered anywhere in the worksheet, you must follow the second and third steps listed previously and then take these three additional steps instead:

1. **Click the List Entries box and then type each of the entries for the custom list in the order in which they are to be entered in successive cells of a worksheet.**

   Press the Enter key after typing each entry for the custom list so that each entry appears on its own line in the List Entries box or separate each entry with a comma.

2. **Click the Add button to add the entries that you've typed to the Custom Lists box.**

   Note that when Excel adds the custom list that you just typed to the Custom Lists box, it automatically adds commas between each entry in the list — even if you pressed the Enter key after making each entry. It also automatically separates each entry on a separate line in the List Entries box — even if you separated them with commas instead of carriage returns.

3. **Click OK to close the Custom Lists dialog box, and then click OK to close the Excel Options dialog box.**

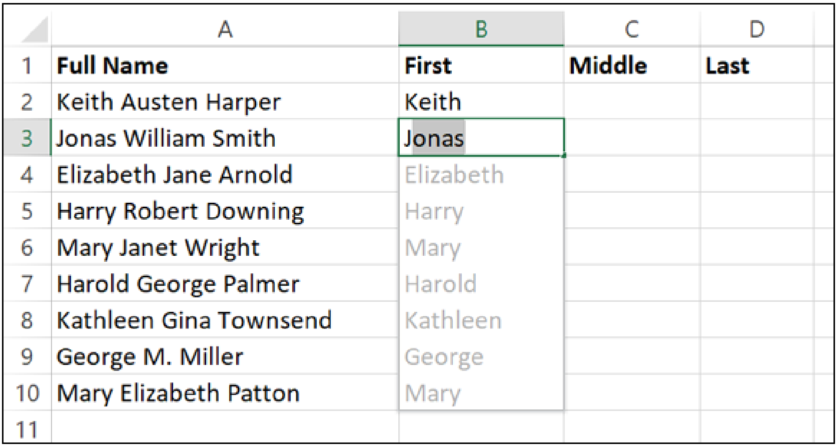
After you’ve created a custom list by using one of these two methods, you can fill in the entire data series by entering the first entry of the list in a cell and then dragging the Fill handle to fill in the rest of the entries. If you ever decide that you no longer need a custom list that you’ve created, you can delete it by clicking the list in the Custom Lists box in the Custom Lists dialog box and then clicking the Delete button. Excel then displays an alert box indicating that the list will be permanently deleted when you click OK. Note that you can’t delete any of the built-in lists that appear in this list box when you first open the Custom Lists dialog box.

REMEMBER You can also fill in any part of the series by entering any one of the entries in the custom list and then dragging the Fill handle in the appropriate direction (down and to the right to enter succeeding entries in the list or up and to the left to enter preceding entries).

Flash Fill to the rescue

Excel’s handy Flash Fill feature gives you the ability to take a part of the data entered into one column of a worksheet table and enter just that data in a new table column using only a few keystrokes. The series of entries appear in the new column the moment Excel detects a pattern in your initial data entry that enables it to figure out the data you want to copy. The beauty is that all this happens without the need for you to construct or copy any kind of formula.

The best way to understand Flash Fill is to see it in action. Figure 1-13 (sample workbook: Full Names.xlsx) contains a new data table consisting of four columns. The first column already contains the full names of clients (first, middle, and last). The second, third, and fourth columns need to have just the first, middle, and surnames, respectively, entered (so that particular parts of the clients’ names can be used in the greetings of form e-mails and letters as in, “Hello Keith,” or “Dear Mr. Harper,”).



	A	B	C	D
1	**Full Name**	**First**	**Middle**	**Last**
2	Keith Austen Harper	Keith		
3	Jonas William Smith	Jonas		
4	Elizabeth Jane Arnold	Elizabeth		
5	Harry Robert Downing	Harry		
6	Mary Janet Wright	Mary		
7	Harold George Palmer	Harold		
8	Kathleen Gina Townsend	Kathleen		
9	George M. Miller	George		
10	Mary Elizabeth Patton	Mary		
11				

FIGURE 1-13: New data table containing full names that need to be split up in separate columns with Flash Fill. (Sample workbook: Full Names.xlsx).

Rather than manually entering the first, middle, or last names in the respective columns (or attempting to copy the entire client name from column A and then editing the parts not needed in the First Name, Middle Name, and Last Name columns), you can use Flash Fill to quickly and effectively do the job. And here's how you do it:

1. **Type** Keith **in cell B2 and complete the entry with the ↓ or Enter key.**

   When you complete this entry with the ↓ key or Enter key on your keyboard, Excel moves the cell pointer to cell B3, where you have to type only the first letter of the next name for Flash Fill to get the picture.

2. **In Cell B3, type only** J**, the first letter of Jonas, the second client's first name.**

   Flash Fill immediately does an AutoFill type maneuver by suggesting the rest of the second client's first name, Jonas, as the text to enter in this cell. At the same time, Flash Fill suggests entering all the remaining first names from the full names in column A in column B. (See Figure 1-13.)

3. **Complete the entry of Jonas in cell B3 by clicking the Enter button or pressing an arrow key.**

The moment you complete the data entry in cell B3, the First Name column is done: Excel enters all the other first names in column B at the same time!

To complete this example name table by entering the middle and last names in columns C and D, respectively, you repeat these steps in those columns. You enter the first middle name, **Austen,** from cell A2 in cell C2 and then type **W** in cell C3. Complete the entry in cell C3 and the middle name entries in that column are done. Likewise, you enter the first last name, **Harper,** from cell A2 in cell D2 and then type **S** in cell D3. Complete the entry in cell D3, and the last name entries for column D are done, finishing the entire data table.

REMEMBER Flash Fill works perfectly at extracting parts of longer data entries in a column provided that all the entries follow the same pattern and use same type of separators (spaces, commas, dashes, and the like). For example, in Figure 1-13, there's an anomaly in the full name entries in cell A9 where only the middle initial with a period is entered instead of the full middle. In this case, Flash Fill enters M in cell C9, and you have to manually edit its entry to add the necessary period. Also, remember that Flash Fill's usefulness isn't restricted to all-text entries as in my example Client Name table. It can also extract parts of entries that mix text and numbers, such as ID numbers (AJ-1234, RW-8007, and so forth).

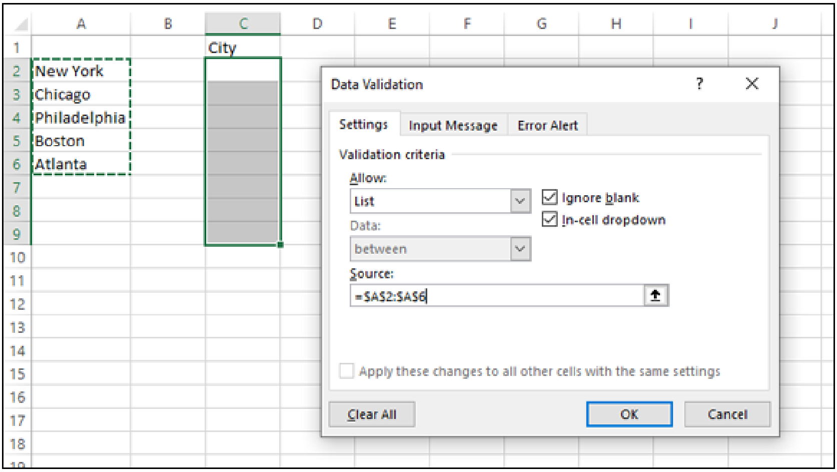
Limiting data entry with Data Validation

The Data Validation feature in Excel can be a real timesaver when you're doing repetitive data entry and can also go a long way in preventing incorrect entries in your worksheets. When you use Data Validation in a cell, you indicate what type of data entry is allowed in the cell. As part of restricting a data entry to a number (which can be a whole number, decimal, date, or time), you also specify the permissible values for that type of number (a whole number between 10 and 100 or a date between January 1, 2022, and December 31, 2022, for example).

When you restrict the data entry to text, you can specify the range of the minimum and maximum text length (in characters) or, even better, a list of permissible text entries that you can choose from a pop-up menu (opened by clicking a pop-up button that appears to the right of the cell whenever it's active).

When using Data Validation to restrict the type of data entry and its range of acceptable values in a cell, you can also specify an input message that is automatically displayed next to the cell when you select it and/or an error alert message that is displayed if you try to input the wrong type of entry or a number outside the permissible range.

To use the Data Validation feature, select the cell or range where you want to restrict the type of data entry that you can make there and then click the Data Validation button on the Data tab of the Ribbon (or press Alt+AVV). The Data Validation dialog box opens with the Settings tab selected (similar to the one shown in Figure 1-14).



City

New York
Chicago
Philadelphia
Boston
Atlanta

Data Validation

Validation criteria

Allow: List

☑ Ignore blank

☑ In-cell dropdown

Data: between

Source: =$A$2:$A$6

☐ Apply these changes to all other cells with the same settings

FIGURE 1-14: Creating a custom drop-down list in the Data Validation dialog box.

You then click the drop-down button attached to the Allow drop-down list box and select among the following items:

- **Any Value:** Removes any previous restrictions thereby canceling data validation and once again enabling the user to enter anything into the cell.
- **Whole Number:** Restricts the entry to a whole number that falls within a certain range or satisfies the parameters you specify.
- **Decimal:** Restricts the entry to a decimal number that falls within a certain range or satisfies the parameters you specify.
- **List:** Restricts the entry to one of several text items that you

specify in a list. The user displays the list by clicking a pop-up button that appears to the right of the cell whenever it contains the active cell.

- **Date:** Restricts the entry to a date that falls within a certain range or on or before a particular date.
- **Time:** Restricts the entry to a time that falls within a certain range or on or before a particular time of the day.
- **Text Length:** Restricts a text entry so that its length in characters falls within a range that you specify.
- **Custom:** Restricts the entry to the parameters specified by a particular formula entered in another cell of the worksheet.

To specify an input message after selecting all the items on the Settings tab, click the Input Message tab of the Data Validation dialog box, where you enter a short title for the input message (such as *List Entry*) in the Title text box, and then enter the text of your message in the Input Message list box below.

To specify an alert message, click the Error Alert tab of the Data Validation dialog box. First, make sure the Show Error Alert After Invalid Data Is Entered check box is selected. Now you can select the kind of warning from the Style drop-down list: Stop (the default, which uses a red button with a cross in it), Warning (which uses a yellow triangle with an exclamation point in it), or Information (which uses a balloon with a blue *I* in it). After selecting the type of alert, you then enter the title for its dialog box in its Title text box and enter the text of the alert message in the Error Message list box.

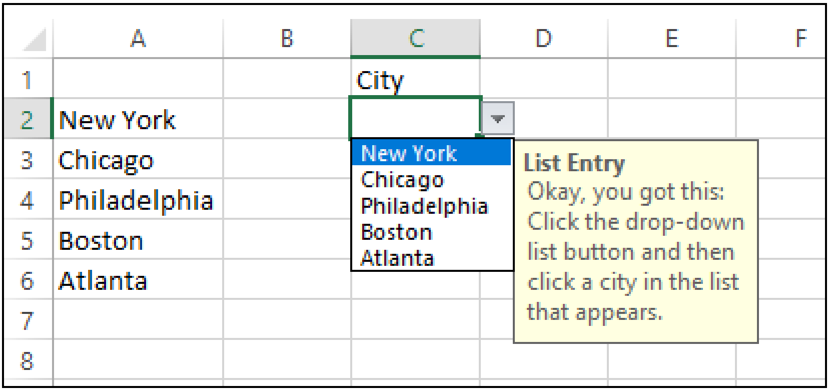
TIP

To apply the restriction you're defining in the Data Validation dialog box to all the other cells that are formatted the same way as in a cell range formatted as a table (see Book 2, Chapter 2 for details), return to the Settings tab, select the Apply These Changes to All Other Cells with the Same Settings check box, and then click OK. To copy the restriction to a range that is not formatted as a table, use the Data Validation feature to set up the type of entry and permitted range in the first cell and then use the Fill handle to copy that cell's Data Validation settings to subsequent cells in the same column or row.

By far, the most popular use of the Data Validation feature is to create a drop-down menu from which you or someone who uses your worksheet can select the appropriate data entry. Figures 1-14 and 1-15 illustrate this type of usage.

As Figure 1-14 shows, on the Settings tab of the Data Validation dialog box, I chose List from the Allow drop-down list box and then in the Source text box, I designated the cell range A2:A6, which just happens to contain the list of allowable entries. (You can type them in the Source text box separated by commas if the list doesn't already exist someplace on the worksheet.) Notice in this figure that when you select List in the Allow combo box, the In-Cell Dropdown check box appears. Keep this check box selected because it tells Excel to create a drop-down list (or pop-up menu, as it's also called) containing only the entries specified in the Source text box.

Figure 1-15 shows you what happens in the worksheet after you close the Data Validation dialog box and then select a cell (C2 in Figure 1-15) in your data validation range. Here, you see the pop-up menu (with a list of cities taken from the cell range A2:A6) as it appears when you click the cell's new pop-up button. In this figure, you can also see the input List Entry message box that I created for this cell by using the options on the Input Message tab of the Data Validation dialog box. Note that you can reposition this message box (officially known as a *Comment box*) so that it's close to the cell but doesn't get in the way of selecting an entry — drag the Comment box with the mouse pointer.

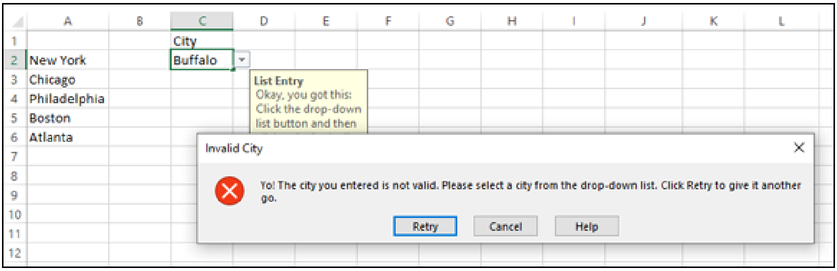


	A	B	C	D	E	F
1			City			
2	New York					
3	Chicago					
4	Philadelphia					
5	Boston					
6	Atlanta					
7						
8						

List Entry
Okay, you got this: Click the drop-down list button and then click a city in the list that appears.

FIGURE 1-15: Selecting a city from the custom drop-down list.

Figure 1-16 demonstrates what happens if you try to input an entry that isn't on the drop-down list. For this figure, I deliberately disregarded the input instructions and typed *Buffalo* as the location. As soon as I clicked the Enter button on the Formula bar, the custom alert dialog box (which I named *Invalid City*) appears. I created this alert dialog box by using the options located on the Error Alert tab of the Data Validation dialog box.



	A	B	C
1			City
2	New York		Buffalo
3	Chicago		
4	Philadelphia		
5	Boston		
6	Atlanta		

List Entry
Okay, you got this:
Click the drop-down
list button and then

Invalid City

Yo! The city you entered is not valid. Please select a city from the drop-down list. Click Retry to give it another go.

FIGURE 1-16: Getting an error message after trying to input a city that's not on the list.

To find cells to which Data Validation has been applied, open the Go To dialog box (Ctrl + G or F5), click Special to open the Go To Special dialog box, and then select the Data Validation option button. Click the Same option button under Data Validation to have Excel go to the next cell that uses the same Data Validation settings as the active cell. Leave the All option button under Data Validation selected to go to the next cell that uses any kind of Data Validation setting.

To get rid of Data Validation settings assigned to a particular cell or cell range, select the cell or range, open the Data Validation dialog box (Alt + AVV), click Clear All, and then click OK.

REMEMBER Although Data Validation is most often used to restrict new data entries in a worksheet, you can also use it to quickly identify values that are outside desired parameters in ranges of existing numeric data entries. See Book 2, Chapter 3 for details.

Linking to Other Documents

The subject of this section is connecting a worksheet to other documents using links. A *link* (sometimes called a *hyperlink*) is a bit of worksheet text — or perhaps a worksheet object such as a button or image — that, when clicked, takes you to another document. Here, “document” is defined broadly as any of the following:

- A separate file, such as a different Excel workbook, a Word document, a PowerPoint presentation, or a text file.
- A different place in the same workbook, such as another tab or a specific cell reference or range name.
- A web page on your company’s network or on the web.

Hyperlinks: the basics

To add links in an Excel worksheet, you must define two things:

- The text or object to which you want to attach the link. This text or object is what you'll click to activate the link.
- The destination to which the link takes you when you click the link.

The objects to which you can attach links include any text that you enter into a cell or any graphic object that you draw or import into the worksheet. (See Book 5, Chapter 2, for details on adding graphics to your worksheet.) The destinations that you can specify for links can be a new cell or range, the same workbook file, or another file outside the workbook.

The destinations that you can specify for links that take you to another place in the same workbook file include

- **The cell reference** of a cell on any of the worksheets in the workbook that you want to go to when you click the link.
- **The range name** of the cell or group of cells that you want to select when you click the link. The range name must already exist at the time you create the link. (See Book 3, Chapter 1 to find out how to create and use range names.)

The destinations that you can specify for links that take you outside the current workbook include

- **The location and filename** of an existing file that you want to open when you click the link. This file can be another workbook file or any other type of document that your computer can open.
- **The address** of a web page that you want to visit when you click

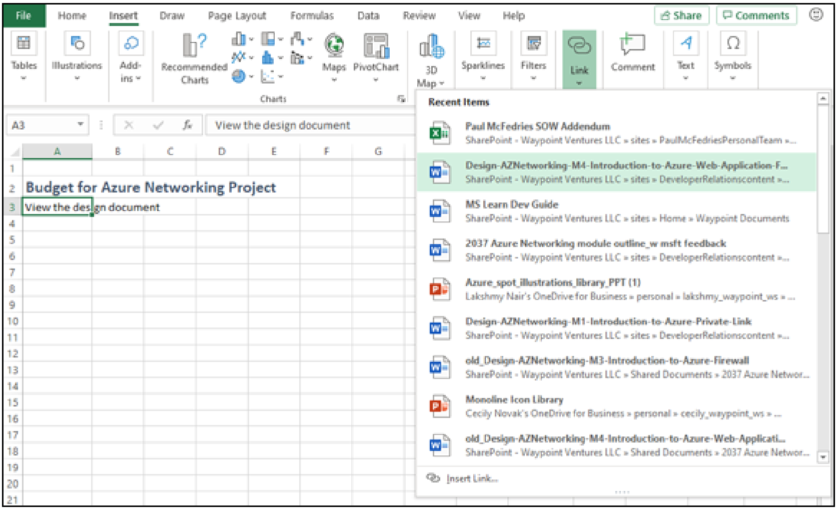
the link. This page can be on your company's network or on the web and is opened in your web browser.

- **An email address** for a new message that you want to create in your email program when you click the link. You must specify the recipient's email address and the subject of the new message when you create the link.

Inserting links

Before getting down to the business of inserting a link, you need to add to your worksheet either the text or the graphic object to which you want to attach the link. With the text or image added, you can now insert the link the easy way or the not-quite-as-easy way.

The easy way is to first click the cell containing your text or click the image you want to use for the link. Now click the Ribbon's Insert tab and then click the lower half of the Link button. Excel displays a menu that includes a Recent Items list similar to the one shown in Figure 1-17. If the document to which you want to link appears in that list, say "Yes!!" and click the document. Excel creates the link just like that.


File
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Help
Share
Comments
Tables
Illustrations
Add-ins
Recommended Charts
Maps
PivotChart
3D Map
Charts
Sparklines
Filters
Link
Comment
Text
Symbols
A3
A
B
C
D
E
F
G
Recent Items
Paul McFedries SOW Addendum
SharePoint - Waypoint Ventures LLC » sites » PaulMcFedriesPersonalTeam »...
Design-AZNetworking-M4-Introduction-to-Azure-Web-Application-F...
SharePoint - Waypoint Ventures LLC » sites » DeveloperRelationscontent »...
MS Learn Dev Guide
SharePoint - Waypoint Ventures LLC » sites » Home » Waypoint Documents
2037 Azure Networking module outline_w msft feedback
SharePoint - Waypoint Ventures LLC » sites » DeveloperRelationscontent »...
Azure_spot_illustrations_library_PPT (1)
Lakshmy Nair's OneDrive for Business » personal » lakshmy_waypoint_ws » ...
Design-AZNetworking-M1-Introduction-to-Azure-Private-Link
SharePoint - Waypoint Ventures LLC » sites » DeveloperRelationscontent »...
old_Design-AZNetworking-M3-Introduction-to-Azure-Firewall
SharePoint - Waypoint Ventures LLC » Shared Documents » 2037 Azure Networ...
Monoline Icon Library
Cecily Novak's OneDrive for Business » personal » cecily_waypoint_ws » ...
old_Design-AZNetworking-M4-Introduction-to-Azure-Web-Applicati...
SharePoint - Waypoint Ventures LLC » Shared Documents » 2037 Azure Networ...
Insert Link...

Budget for Azure Networking Project

View the design document

FIGURE 1-17: Click the lower half of the Link button to see a list of recent documents you can link to.

For the not-quite-as-easy-way, follow these steps:

1. **Position the cell pointer in the cell containing the text or click the graphic object to which you want to attach the link.**

2. **Click the Ribbon's Insert tab and then either click the top half of the Link button, or click the lower half of the Link button and then click Insert Link. (You can also press either Alt+NI2I or Ctrl+K.)**

   The Insert Hyperlink dialog box opens (similar to the one shown in Figure 1-18). If you selected a graphic object or a cell that contains some entry besides text before opening this dialog box, you notice that the Text to Display text box contains <<Selection in Document>> and that this box is grayed out (because there isn’t any text to edit when anchoring a link to a graphic). If you selected a cell with a text entry, that entry appears in the Text to Display text box. You can edit this text in this box; however, be aware that any change that you make to it here is reflected in the active cell when you close the Insert Hyperlink dialog box.

   The ScreenTip button located to the immediate right of the Text to Display text box enables you to add text describing the function of the link when you position the mouse pointer over the cell or graphic object to which the link is attached. To add a ScreenTip for your link, follow Step 3. Note that if you don’t add your own ScreenTip, Excel automatically creates its own ScreenTip that lists the destination of the new link when you position the mouse pointer on its anchor.

3. **(Optional) Click the ScreenTip button to open the Set Hyperlink ScreenTip dialog box, type the text you want to appear when the mouse pointer hovers over the link, and then click OK.**

   By default, Excel selects the Existing File or Web Page button in the Link To area on the left side of the Insert Hyperlink dialog box, which enables you to assign the link destination to a file on your hard drive or to a web page. The Place in This Document button enables you to link to a cell or cell range in the current workbook; the Create New Document button enables you to link to a new document; and the E-Mail Address button enables you to create a link that launches a new email.

4. **Select the type of destination for the new link by clicking its button in the Link To panel on the left side of the Insert Hyperlink dialog box.**

   Now you need to specify the destination for your link. How you do this depends on which type of link you're adding:

   - *Linking to an existing file:* Click the Existing File or Web Page button, and then use the Link To list to select the location of the file. Click Current Folder (it's selected by default) and then click the file. Excel adds the file location to the Address text box. (An alternative method is to click the Recent Files button and then click the file in the list that appears.)

   - *Linking to a web page:* Click the Existing File or Web Page button, and then type or paste the web address in the Address text box. (An alternative method is to click the Browsed Pages button and then click the web page address in the list that appears.)

   - *Linking to a cell in the current workbook:* Click the Place in This Document button, and then use the Type the Cell Reference text box to enter the address of the cell. In the Or Select a Place in This Document list, click the name of the worksheet where the cell resides.

   - *Linking to a worksheet in the current workbook:* Click the Place in This Document button, and then use the Or Select a Place in This Document list to click the name of the worksheet.

   - *Linking to a range name in the current workbook:* Click the Place in This Document button, and then use the Or Select a Place in This Document list to click the range name under the Defined Names heading.

- *Linking to a new email:* Click the E-Mail Address button, and then use the E-Mail Address text box to type the email address. (Or click the address in the Recently Used E-Mail Addresses section, if it appears there.) Use the Subject text box to type the subject line of the new email message.

11. **Click OK.**

    Excel inserts the link.

If you attached your new link to a graphic object, that object is still selected in the worksheet. (To deselect the object, click a cell outside its boundaries.) If you attached your link to text in the active cell, the text now appears in blue and is underlined. (You may not be able to see the underlining until you move the active cell out of the cell.)

When you position the mouse pointer over the link, the mouse or Touch pointer changes from a thick, white cross to a hand with the index finger pointing upward. The ScreenTip that you assigned appears below and to the right of the hand mouse pointer.

If you didn't assign your own ScreenTip to the link when creating it, Excel adds its own message that shows the destination address of the link. If the link is text, the message in the ScreenTip also adds the following message:

```
Click once to follow. Click and hold to select this cell.
```

Follow that link!

To follow a link, click the link text or graphic object with the mouse or Touch pointer. Excel then takes you to the destination. If the destination is a cell in the workbook, Excel makes that cell current. If the destination is a cell range, Excel selects the range and makes the first cell of the range current. If this destination is a document created with another application program, Excel launches the application program (assuming that it's available on the current computer). If this destination is a web page, Excel opens the page in your browser.

After you follow a text link to its destination, the color of its text changes from the traditional blue to a dark shade of purple (without affecting its underlining). This color change indicates that the link has been followed. (Note, however, that graphic links don't show any change in color after you follow them.) Followed text links regain their original blue color when you reopen their workbooks in Excel.

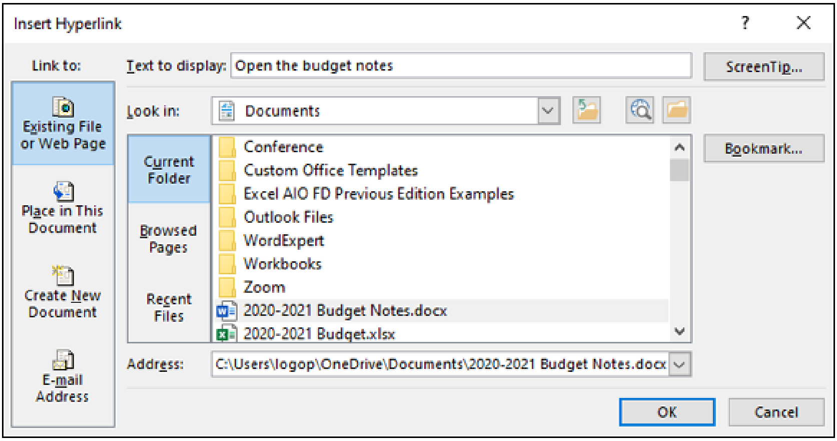
Editing links

REMEMBER Excel makes it easy to edit any link that you've added to your worksheet. The only trick to editing a link is that you must be careful not to activate the link during the editing process. This means that you must always remember to right-click the link's text or graphic because clicking results only in activating the link.

When you right-click a link, Excel displays its shortcut menu. If you want to modify the link's destination or ScreenTip, click Edit Hyperlink on this shortcut menu. This action opens the Edit Hyperlink dialog box with the same options as the Insert Hyperlink dialog box (shown previously in Figure 1-18).

Removing a link

If you want to remove the link without getting rid of the link's text entry or graphic, right-click the cell or graphic and then click the Remove Hyperlink command.



Insert Hyperlink

Text to display: Open the budget notes

Look in: Documents

Address: C:\Users\logop\OneDrive\Documents\2020-2021 Budget Notes.docx

?
Link to:
Existing File or Web Page
Place in This Document
Create New Document
E-mail Address
ScreenTip...
Current Folder
Browsed Pages
Recent Files
Conference
Custom Office Templates
Excel AIO FD Previous Edition Examples
Outlook Files
WordExpert
Workbooks
Zoom
2020-2021 Budget Notes.docx
2020-2021 Budget.xlsx
Bookmark...
OK
Cancel

FIGURE 1-18: Use the Insert Hyperlink dialog box to insert a link in a worksheet.

If you want to clear the cell of both its link and text entry, right-click the cell and then click Delete. To get rid of a graphic object along with its link, right-click the object (this action opens its shortcut menu) and then immediately click the object to remove the shortcut menu without either deselecting the graphic or activating the link. At this point, you can press the Delete key to delete both the graphic and the associated link.

Selecting a link without activating it

When you need to perform some action on a link — such as formatting the link's text or graphic or moving the link to a new location — you first need to select the text or graphic. The challenge here is to select the link without activating it because clicking the cell or graphic object containing the link results in catapulting you over to the link’s destination point.

To select a cell that contains a text link, click and hold on that cell for a couple of seconds. Alternatively, use the arrow keys to position the active cell in that cell or use the Go To feature (F5 or Ctrl+G) and enter the cell’s address in the Go To dialog box to move the active cell there. To select a graphic object that contains a link, right-click the graphic to select it as well as to display its shortcut menu and then immediately click the graphic (with the left mouse button) to remove the shortcut menu while keeping the object selected.

Using the HYPERLINK Function

Instead of using the Link command button on the Insert tab of the Ribbon, you can use Excel’s HYPERLINK function to create a hypertext link. (You can’t use this function to attach a link to a graphic object.) The HYPERLINK function uses the following syntax:

```
HYPERLINK(link_location,[friendly_name])
```

TECHNICAL STUFF

HOW TO TELL A UNC FROM A URL ADDRESS AND WHEN TO CARE

The address that you use to specify a remote link destination comes in two basic flavors: UNC (Universal Naming Convention) and the more familiar URL (Universal Resource Locator). The type of address that you use depends on whether the destination file resides on a server on a local network (in which case, you use a UNC address) or on a corporate intranet or the Internet (in which case, you use a URL address). Note that URLs also appear in many flavors, the most popular being those that use the Hypertext Transfer Protocol (HTTP) and begin with `http://` and those that use the Hypertext Transfer Protocol Secure (HTTPS) and start with `https://`.

The UNC address for destination files on network servers start with two backslash characters (\\), following this format:

```
\\server\share\path\filename
```

In this format, the name of the file server containing the file replaces *`server`*, the name of the shared folder replaces *`share`*, the directory path specifying any subfolders of the shared folder replaces *`path`*, and the file's complete filename (including any filename extension, such as `.xlsx` for Excel worksheet) replaces *`filename`*.

The URL address for files published on websites follows this format:

```
internet service//internet address/path/filename
```

In this format, *`internet service`* is replaced with the Internet protocol to be used (either HTTP or HTTPS in most cases), *`internet service`* is replaced with the domain name (such as `www.dummies.com`) or the number assigned to the internet server, *`path`* is the directory path of the file, and *`filename`* is the complete name (including filename extensions such as `.htm` or `.html` for web pages).

When specifying the arguments for a HYPERLINK function that you type on the Formula bar (as opposed to one that you create by using the Insert Function feature by filling in the text boxes in the Function Arguments dialog box), you must remember to enclose both the *link_location* and *friendly_name* arguments in double-quotes. For example, to enter a HYPERLINK function in a cell that takes you to the home page of the *For Dummies* website and displays the text “Dummies Home Page” in the cell, enter the following in the cell:

```
=HYPERLINK("http://www.dummies.com","Dummies Home Page")
```

The *link_location* argument specifies the name of the document to open on your local hard drive, on a network server (designated by a UNC address), or on the company’s intranet or the web (designated by the URL address — see the sidebar “How to tell a UNC from a URL address and when to care" for details). The optional *friendly_name* argument is the link text that appears in the cell where you enter the HYPERLINK function. If you omit this argument, Excel displays the text specified as the *link_location* argument in the cell.

Saving the Data

One of the most important tasks you ever perform when building your worksheet is *saving your work!* Excel offers three different ways to invoke the Save command:

- Click the Save button on the Excel title bar, pointed out in Figure 1-19. (Unless you were born well before the year 2000, you may not have any idea what this icon represents. It is, in fact, an icon of an old storage medium called a 3.5-inch floppy disk. Google it if you're curious about this now ancient technology.)
- Press Ctrl + S or F12.
- Choose File ⇒ Save.

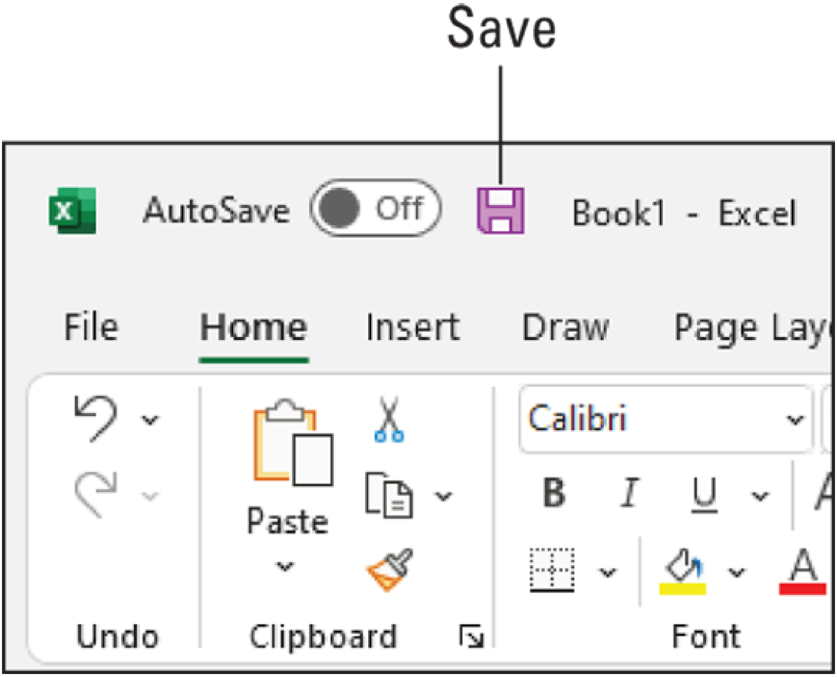

Save
AutoSave
Off
Book1 - Excel
File
Home
Insert
Draw
Page Lay
Calibri
B
I
U
Paste
Undo
Clipboard
Font

FIGURE 1-19: The Excel title bar comes with a Save icon.

TIP

Use any of these methods (frequently!) when you've stored your workbook on your computer's hard drive. If, instead, you stored your workbook file in an online location such as a folder on your OneDrive or SharePoint site, these methods are unnecessary. Why? Because for online files, Excel activates its AutoSave feature, which automatically saves any changes you make to the workbook without you having to bother with any of the Save methods. Woot!

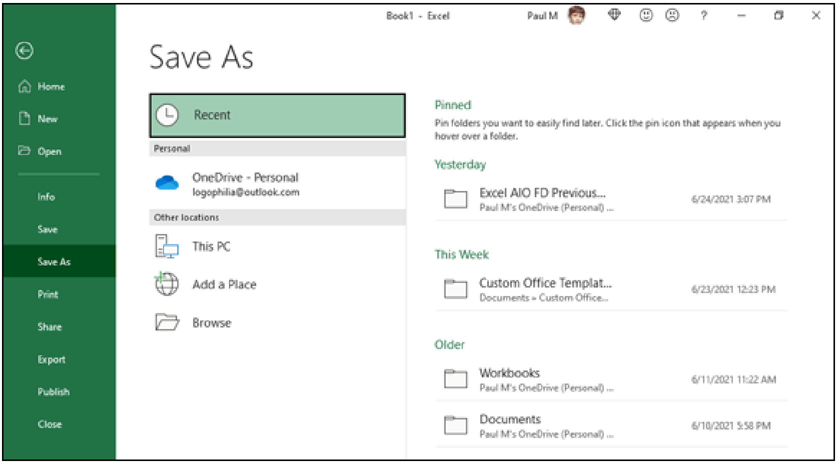
TECHNICAL STUFF

WHAT'S UP WITH THE OneDrive?

You’ve undoubtedly heard of the *cloud*, but your understanding of it may yet be as nebulous as its name. OneDrive is the current name of Microsoft’s storage space in the cloud that it lends to its users with a Windows account The great thing about saving a workbook file in a folder on your OneDrive is that you then can open it for further editing and printing from any device running Excel that has Internet access. For example, if you save a workbook file that you create in Excel on your office desktop computer, you can then open it for more editing on your laptop at home or even your Windows tablet or smartphone at the local coffee shop.

After you create a new workbook, when you click the Save button or press Ctrl + S for the first time, Excel displays the Save This File dialog box. Use the File Name text box to name your workbook, use the Choose a Location list to select where you want the workbook saved, and then click Save.

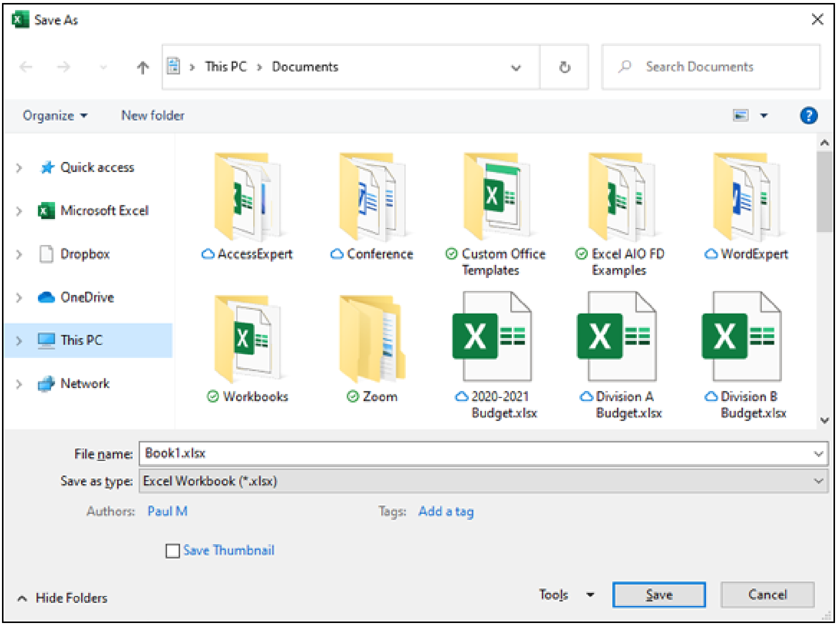
Alternatively, if you want more choices for saving, click the More Options link (or choose File ⇒ Save), which opens the Save As screen in the Backstage view similar to the one shown in Figure 1-20.


Book1 - Excel
Paul M
Save As
Home
New
Open
Info
Save
Save As
Print
Share
Export
Publish
Close
Recent
Personal
OneDrive - Personal
logophilia@outlook.com
Other locations
This PC
Add a Place
Browse
Pinned
Yesterday
Excel AIO FD Previous...
Paul M's OneDrive (Personal) ...
6/24/2021 3:07 PM
This Week
Custom Office Templat...
Documents » Custom Office...
6/23/2021 12:23 PM
Older
Workbooks
Paul M's OneDrive (Personal) ...
6/11/2021 11:22 AM
Documents
Paul M's OneDrive (Personal) ...
6/10/2021 5:58 PM

Pin folders you want to easily find later. Click the pin icon that appears when you hover over a folder.

FIGURE 1-20: Use the Save As screen to specify where you want to save a new workbook.

To save the file locally instead — that is, on your computer's hard drive or a virtual drive on your company's local area network — select the Browse button. The Save As dialog box opens with the default location for saving workbook files from which you can select the drive and folder where the new workbook should be stored (see Figure 1-21). Use this dialog box to replace the temporary document name (Book1, Book2, and so forth) with a more descriptive filename in the File Name text box; to select a new file format from the Save As Type drop-down list box; and, if necessary, to select a new folder where it's to be stored before you save the workbook.


Save As
This PC › Documents
Search Documents
Organize
New folder
Quick access
Microsoft Excel
Dropbox
OneDrive
This PC
Network
AccessExpert
Conference
Custom Office Templates
Excel AIO FD Examples
WordExpert
Workbooks
Zoom
2020-2021 Budget.xlsx
Division A Budget.xlsx
Division B Budget.xlsx
Save Thumbnail
Hide Folders
Tools
Save
Cancel

File name: Book1.xlsx

Save as type: Excel Workbook (*.xlsx)

Authors: Paul M

Tags: Add a tag

☐ Save Thumbnail

FIGURE 1-21: Specifying the folder and filename prior to saving the new workbook file.

When you finish making changes in the Save As dialog box, click the Save button or press Enter to have Excel save your work. When Excel saves your workbook file, the program saves all the information in every worksheet in your workbook (including the last position of the active cell) in the designated folder and drive.

REMEMBER You don't have to fool with the Save As dialog box ever again after initially saving a workbook unless you want to save a copy of the workbook under a new filename and/or in a new folder. If you want to do either of these things, you must choose File ⇒ Save As or press Alt + FA to select the Save As command rather than click the Save button on the Excel title bar or press Ctrl + S. Then, select the folder where you want the new version of the file saved if it's different from the current folder, and you can edit the workbook's filename if you also want to rename the workbook file.

TIP The Save As dialog box enables you to change the author or add a title and/or tags to the new workbook file by clicking the Authors or Add a Tag link. You can then use any or all of these pieces of information you add to the file when later searching for the workbook. Click the Save Thumbnail check box to have Excel save a preview of the workbook's initial worksheet that can be displayed in the Preview pane of the Open dialog box or when viewing the workbook files with the Large Icons or Extra Large Icons settings. (See Book 2, Chapter 3 for details.)

Saving workbooks in other commonly used file formats

When you click the Save As Type drop-down button in the Save As dialog box, Excel displays a long laundry list of file formats that you can choose from when saving the workbook file. You can use these file format options to instantly convert your worksheet data into another file format for use with Excel or some other application.

TIP Before saving a new workbook file in a non-Excel file format for use with another type of program (such as Web Page for the Internet, or PDF for Adobe Reader), be sure that you've first saved the worksheet data in a regular Excel Workbook file. That way, you continue to have ready access to the data in Excel for further editing, printing, and so forth without having to convert the new file back into a native Excel Workbook file format.

The most commonly used file format options include the following:

- **Excel Workbook:** Saves the workbook in the default Excel `.xlsx` file format.
- **Excel Macro-Enabled Workbook:** Saves the workbook in the default `.xlsm` file format with all macros (see Book 8, Chapter 1) it contains enabled.

- **Excel 97–2003 Workbook:** Saves the workbook in `the .xls` file format used by earlier versions of Excel 97 through Excel 2003. Note that an alert dialog box appears if Excel finds any features used in the workbook that aren't supported in this file format.
- **XML Data:** Saves the workbook in an XML (Extensible Markup Language) format (using the `.xml` filename extension) often used to exchange lists of data over the Internet.
- **Web Page:** Saves the workbook in an HTML (Hypertext Markup Language) used to render all the data on all worksheets in the workbook in a single continuous web page with the `.htm` or `.html` filename extension.
- **Excel Template:** Saves the workbook in the `.xltx` file format as an Excel template file that you can use to generate new workbooks containing the same layout and content as the template.
- **Excel Macro-Enabled Template:** Saves the workbook in the `.xltm` template file format with all the macros (see Book 8, Chapter 1) it contains enabled.
- **PDF:** Saves the workbook in an Adobe PDF (Portable Document File) format with the `.pdf` filename extension that can be opened with Adobe Reader.
- **OpenDocument Spreadsheet:** Saves the workbook in ODF (OpenDocument Format) with an `.ods` filename extension that's used by other Office suites of programs, such as LibreOffice.

REMEMBER Although less frequently needed, don't forget that the Save As options include a number of text file conversions that you can use when your worksheet contains lists of data that you need to make available to programs that can deal with strings of text data. The major difference between the text file formats is what character they use to separate the data in each worksheet cell. So, the Text (Tab Delimited) formats use tabs, the CSV (Comma Delimited) formats use commas, and the Text formats use spaces.

Changing the default file location

Whenever you click the This PC button under Locations on the Save As screen in the Backstage view to save a new workbook file locally (as opposed to in the cloud on a SharePoint site or your OneDrive), Excel automatically selects the folder listed in the Default File Location text box on the Save tab of the Excel Options dialog box (File ⇒ Options ⇒ Save or Alt + FTS).

TIP If you don't have a OneDrive or don’t ever save workbook files in the cloud, you can prevent Excel from asking you to sign into your OneDrive location when saving a new workbook by deselecting the Show Additional Places for Saving, Even If Sign-In May Be Required check box on the Save tab of the Excel Options dialog box. Also, if you prefer selecting the drive and folder into which to save your workbook files directly in the Save As dialog box, you can prevent Excel from initially displaying the Save As screen by selecting the Don’t Show the Backstage When Opening or Saving Files check box on this same tab of the Excel Options dialog box.

The very generic Documents folder may not be the place on your hard drive where you want all the new workbooks you create automatically saved. To change the default local file location to another folder on your computer, follow these steps:

1. **Choose File ⇒ Options ⇒ Save or press Alt + FTS to open the Save tab of the Excel Options dialog box.**

   The Default Local File Location text box displays the directory path to the current default folder.

2. **Double-click the Default File Location text box to select the current directory path.**

   When you double-click the Default File Location text box, Excel selects the entire directory path so that if you begin typing, the characters you type replace the entire path. To edit part of the path (such as the Documents folder name after your username), click the mouse or Touch pointer at that place in the path to set the insertion point.

3. **Edit the existing path or replace it with the path to another**

existing folder in which you want all future workbooks to automatically be saved.

4. **Click OK to close the Excel Options dialog box.**

Saving a new workbook in the old file format

Excel automatically saves each new workbook file in a Microsoft version of the XML-based file format, which carries the filename extension `.xlsx`. The problem with this XML file format is that it’s not one that versions of Excel prior to Excel 2007 can open. This means that if everybody who needs to work with the workbook you’ve just created hasn’t yet upgraded to Excel 2007 or 2010, you need to save the new workbook in the earlier file format used in versions 97 through 2003 with the old `.xls` filename extension.

To save a new workbook in the old binary Excel file format for back compatibility, be sure to click the Save as Type drop-down button and then select Excel 97-2003 Workbook from the drop-down list.

WARNING Excel automatically displays the Excel Compatibility Checker dialog box whenever you try to save a workbook file containing Excel features that aren't supported in earlier versions of the program from Excel 97–2003. This dialog box lists each incompatible feature in the workbook and gives you details on what will happen to the feature if you go ahead and save the workbook file in the older file format. To ignore these warnings and go ahead and save your workbook in the 97–2003 binary format, click the Continue button in the Excel Compatibility Checker dialog box.

TIP If you still want to have access to all the features in the Excel workbook but you still need to create a backwardly compatible version of the workbook file (even if it has less fidelity), first save the workbook in the XML file format with the `.xlsx` file extension. Then, save a copy in old 97-2003 binary file format with the `.xls` file extension by opening the Save As dialog box (File ⇒ Save As or Alt+FA) and then selecting Excel 97-2003 from the Save as Type drop-down list before clicking the Save button.

REMEMBER Keep in mind that filename extensions such as `.xlsx` and `.xls` do not appear as part of the filename (even though they are appended) in the File Name text box in the Save As dialog box unless you click the File Name Extensions check box found on the View tab in the Windows File Explorer window to select it.

Document Recovery to the Rescue

Excel offers a document recovery feature that can help you in the event of a computer crash because of a power failure or some sort of operating system freeze or shutdown. The AutoRecover feature saves your workbooks at regular intervals. In the event of an Excel or computer crash, Excel displays a Document Recovery task pane the next time you start Excel after rebooting the computer.

TIP When you first start using Excel, the AutoRecover feature is set to automatically save changes to your workbook (provided that the file has already been saved) every ten minutes. You can shorten or lengthen this interval as you see fit. Choose File ⇒ Options ⇒ Save or press Alt+FTS to open the Excel Options dialog box with the Save tab selected. Use the spinner buttons or enter a new automatic save interval into the Save AutoRecover Information Every 10 Minutes text box before clicking OK.

The Document Recovery Task pane shows the available versions of the workbook files that were open at the time of the computer crash. It identifies the original version of the workbook file and when it was saved, along with the recovered version of the file and when it was saved. To open the recovered version of a workbook (to see how much of the work it contains that was unsaved at the time of the crash), position the mouse pointer over the AutoRecover version. Then click its drop-down menu button and click Open on its pop-up menu. After you open the recovered version, you can (if you choose) then save its changes by clicking the Save button on the Excel title bar or by choosing File ⇒ Save.

You then have these choices:

- To save the recovered version of a workbook without bothering to first open it, place your mouse over the recovered version, click its drop-down button, and click the Save As option on the pop-up menu.
- To permanently abandon the recovered version (leaving you with *only* the data in the original version), click the Close button at the bottom of the Document Recovery Task pane. When you click the Close button, an alert dialog box appears, giving you the chance to retain the recovered versions of the file for later viewing.
- To retain the files for later viewing, select the Yes (I Want to View These Files Later) radio button before clicking OK.
- To retain only the original versions of the files shown in the Task pane, select the No (Remove These Files. I Have Saved the Files I Need) radio button instead.

WARNING The AutoRecover feature only works on Excel workbooks that have been saved at least one time (as explained in the earlier section “Saving the Data”). In other words, if you build a new workbook and don’t bother to save and rename it prior to experiencing a computer crash, the AutoRecover feature will not bring back any part of it. For this reason, it’s really important that you get into the habit of saving new workbooks with the Save button on the Excel title bar immediately after creating a workbook. Or you can use the trusty keyboard shortcut Ctrl + S whenever you make a significant change to the file.

Chapter 2

Formatting Worksheets

IN THIS CHAPTER

- **Selecting cell ranges and adjusting column widths and row heights**
- **Formatting cell ranges as tables**
- **Assigning number formats**
- **Making alignment, font, border, and pattern changes**
- **Using the Format Painter to quickly copy formatting**
- **Formatting cell ranges with Cell Styles**
- **Applying conditional formatting**

When it comes to populating a worksheet with data, Excel doesn't put a lot of hurdles in your path. Most of the time, you click the cell you want to use, type your label or data, press Enter, and — voilà! — you've got yourself a cell entry. Repeat as needed and soon enough your worksheet is done.

Or is it? The problem with Excel's data entry process is that it tends to produce worksheets that are, well, unattractive: All the text is the same size and the same color; some longer cell entries appear truncated; columns of data and labels are misaligned. It's a mess! So, sure, Excel makes it easy to add data, but to make that data look presentable requires more work.

Why should you care about how your worksheets look? After all, most of the time you're the only person who'll seem them, right? Perhaps. But even if your eyeballs are the only ones that will grace your worksheets, there are lots of advantages to taking a bit of extra time to make things look nice. *Formatting* a worksheet — the process of adding fonts and colors, adjusting column widths and row heights, aligning data, adding borders, and much more — makes the worksheet easier to read, helps you find errors, and gives you a hand spotting trends and performing other types of data analysis. And all those advantages are doubled if you plan to share your workbooks with colleagues and co-workers.

In this chapter, you explore Excel's extensive worksheet formatting options. After a brief foray into selecting cells, you dive into the deep end of formatting cells, rows, columns, ranges, tables, and more. Your worksheets are going to look *so* good by the time you're done with this chapter.

Selecting Cells and Ranges

Before you can modify the appearance of anything in a worksheet, you must first select the cells you want to work with.

In Excel, you can select a single cell, a block of cells (known as a *cell range*), or various discontinuous cell ranges (also known as a *nonadjacent selection*). Figure 2-1 shows a nonadjacent selection that consists of several different cell ranges (the smallest range is the single cell I9).

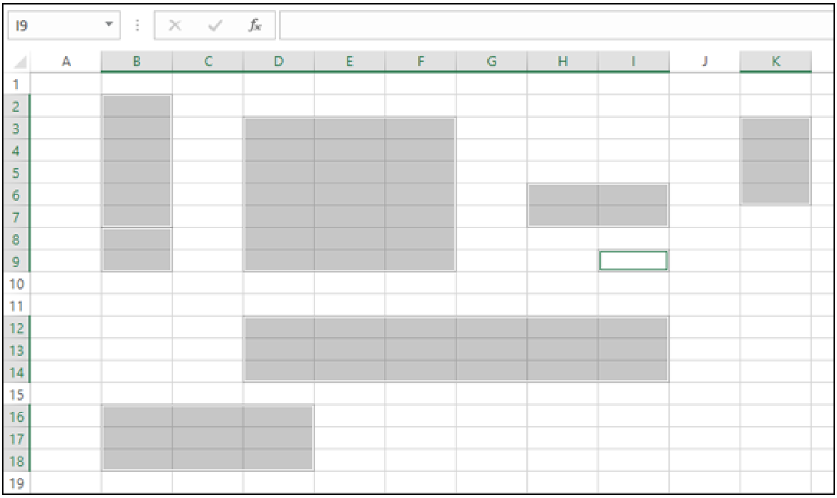


FIGURE 2-1: Worksheet with a nonadjacent cell selection made up of several different sized ranges.

REMEMBER Note that a simple cell selection consisting of a single cell range is denoted in the worksheet both by highlighting the selected cells in a light gray color as well as by extending the border of the cell cursor so that it encompasses all the highlighted cells. In a nonadjacent cell selection, however, all selected cells are highlighted but only the active cell (the one whose address is displayed in the Name Box on the Formula bar) contains the cell cursor (whose borders are quite thin when compared to the regular cell cursor).

REMEMBER Cell ranges are always noted in formulas by the upper-left and lower-right cells that you select, separated by a colon (:); therefore, if you select cell A1 as the first cell and cell H10 as the last cell and then use the range in a formula, the cell range appears as A1:H10.

Selecting cells with the mouse

Excel offers several methods for selecting cells with the mouse. With each method, you start by selecting one of the cells that occupies the corner of the range that you want to select. The first corner cell that you click becomes the *active cell* (indicated by its cell reference in the Formula bar's Name box), and the cell range that you then select becomes anchored on this cell.

After you select the active cell in the range, drag the pointer to extend the selection until you have highlighted all the cells that you want to include. Here are some tips:

- To extend a range in a block that spans several columns, drag right or left from the active cell.
- To extend a range in a block that spans several rows, drag down or up from the active cell.
- To extend a range in a block that spans several columns and rows, drag diagonally from the active cell in the most logical directions (up and to the right, down and to the right, up and to the left, or down and to the left).

If you ever extend the range too far in one direction, you can always reduce it by dragging in the other direction. If you’ve already released the mouse button and you find that the range is incorrect, click the active cell again. (Clicking any cell in the worksheet deselects a selected range and activates the cell that you click.) Then select the range of cells again.

TIP

You can always tell the active cell that forms the anchor point of a range because it's the only cell within the range that you’ve selected that isn’t highlighted and is the only cell reference listed in the Formula bar's Name box. As you extend the range by dragging the thick white-cross mouse pointer, Excel indicates the current size of the range in columns and rows in the Name box (as in 5R x 2C when you’ve highlighted a range of five rows long and two columns wide). However, as soon as you release the mouse button, Excel replaces this row and column notation with the address of the active cell.

You can also use the following shortcuts when selecting cells with the mouse:

- To select a single-cell range, click the cell.
- To select all cells in an entire column, position the mouse pointer on the column letter in the column header and then click. To select several adjacent columns, drag through their column letters in the column header.
- To select all cells in an entire row, position the mouse pointer on the row number in the row header and then click. To select several adjacent rows, drag through the row numbers in the row header.
- To select all the cells in the worksheet, click the box in the upper-left corner of the worksheet at the intersection of row and column headers with the triangle in the lower-right corner that makes it look like the corner of a dog-eared or folded down book page. (You can also do this from the keyboard by pressing Ctrl+A.)
- To select a cell range composed of partial columns and rows without dragging, click the cell where you want to anchor the range, hold down the Shift key, and then click the last cell in the range and release the Shift key. (Excel selects all the cells in between the first and the last cell that you click.) If the range that

you want to mark is a block that spans several columns and rows, the last cell is the one diagonally opposite the active cell. When using this Shift + click technique to mark a range that extends beyond the screen, use the scroll bars to display the last cell in the range. (Just make sure that you don't release the Shift key until after you've clicked this last cell.)

- To select a nonadjacent selection consisting of several discontinuous cell ranges, drag through the first cell range and then hold down the Ctrl key as you drag through the other ranges. After you have marked all the cell ranges to be included in the nonadjacent selection, you can release the Ctrl key.

TIP

The Ctrl key can work with the mouse like an *add* or *subtract* key in Excel. As an add key, you use it to include non-neighboring objects in the current worksheet. See the section "Selecting cells with the keyboard," later in this chapter. By using the Ctrl key, you can add to the selection of cells in a worksheet without having to deselect those already selected. To use the Ctrl key to deselect a range of cells within the current cell selection, hold down Ctrl and drag through the range that you want to deselect (subtract from the selected range) before releasing the mouse button and Ctrl key.

Selecting cells by touch

TIP

If you're running Excel on a touchscreen device without the benefit of a mouse or physical keyboard, you can use your finger or stylus to make your cell selections:

- Tap the first cell in the selection (the equivalent of clicking with a mouse). Selection handles (with the circle icons) appear in the upper-left and lower-right corner of the selected cell. Drag or swipe one of the selection handles through the rest of the adjacent cells to extend the cell selection and select the entire range.
- Tap the first cell and then drag the white-cross pointer to the last cell in the selection.

Selecting cells with the keyboard

Excel also makes it easy for you to select cell ranges with a physical or Touch keyboard by using a technique known as *extending a selection*. To use this technique, you move the cell cursor to the active cell of the range; then press F8 to turn on Extend Selection mode (indicated by Extend Selection on the Status bar) and use the direction keys to move the pointer to the last cell in the range. Excel selects all the cells that the cell cursor moves through until you turn off Extend Selection mode (by pressing F8 again).

You can use the mouse as well as the keyboard to extend a selection when Excel is in Extend Selection mode: Click the active cell, press F8, and then click the last cell to mark the range.

You can also select a cell range with the keyboard without turning on Extend Selection mode. Here, you use a variation of the Shift+click method by moving the cell pointer to the active cell in the range, holding down the Shift key, and then using the direction keys to extend the range. After you've highlighted all the cells that you want to include, release the Shift key.

To mark a nonadjacent selection of cells with the keyboard, you need to combine the use of Extend Selection mode with that of Add to Selection mode. To turn on Add to Selection mode (indicated by Add to Selection on the status bar), you press Shift+F8. To mark a nonadjacent selection by using Extend Selection and Add to Selection modes, follow these steps:

1. **Move the cell cursor to the first cell of the first range you want to select.**
2. **Press F8 to turn on Extend Selection mode.**
3. **Use the arrow keys to extend the cell range until you've highlighted all its cells.**
4. **Press Shift+F8 to turn off Extend Selection mode and turn on Add to Selection mode instead.**
5. **Move the cell cursor to the first cell of the next cell range you want to add to the selection.**
6. **Press F8 to turn off Add to Selection mode and turn Extend Selection mode back on.**
7. **Use the arrow keys to extend the range until all cells are highlighted.**

8. **Repeat Steps 4 through 7 until you've selected all the ranges that you want included in the nonadjacent selection.**
9. **Press F8 to turn off Extend Selection mode.**

Selecting cells with AutoSelect

Excel's AutoSelect feature provides a particularly efficient way to select all or part of the cells in a large table of data. AutoSelect automatically extends a selection in a single direction from the active cell to the first nonblank cell that Excel encounters in that direction.

You can use the AutoSelect feature with the mouse and a physical keyboard. The general steps for using AutoSelect to select a table of data with the mouse are as follows:

1. **Click the first cell to which you want to anchor the range that you are about to select.**

   In a typical table, this cell may be the blank cell at the intersection of the row of column headings and the column of row headings.

2. **Position the mouse pointer on the edge of the cell in the direction you want to extend the range.**

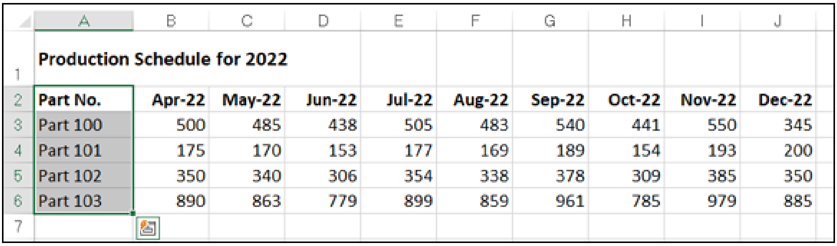
   To extend the range up to the first blank cell to the right, position the mouse or Touch pointer on the right edge of the cell. To extend the range left to the first blank cell, position the pointer on the left edge of the cell. To extend the range down to the first blank cell, position the pointer on the bottom edge of the cell. And to extend the range up to the first blank cell, position the pointer on the top edge of the cell.

3. **When the pointer changes shape from a cross to a four-headed arrow, hold down the Shift key and then double-click the mouse.**

   As soon as you double-click the mouse or Touch pointer, Excel extends the selection to the first occupied cell that is adjacent to a blank cell in the direction of the edge that you double-clicked.

To get an idea of how AutoSelect works, consider how you use it to select all the data in the table (cell range A3:J8) shown in Figures 2-2 and 2-3 (sample workbook: Production Schedule 2022.xlsx for both). You can use the AutoSelect feature to select all the cells in the table in two operations:

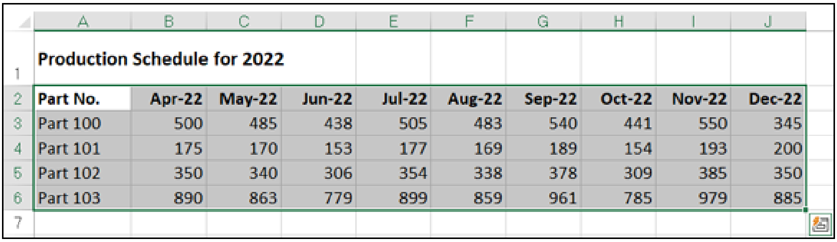
- In the first operation, select cell A2, hold down the Shift key, and then double-click the bottom edge of cell A2 to highlight the cells down to A6, selecting the range A2:A6. (See Figure 2-2.)
- In the second operation, hold down the Shift key and then double-click the right edge of cell range A2:A6 to extend the selection to the last column in the table (selecting the entire table with the cell range A2:J6, as shown in Figure 2-3).



Production Schedule for 2022

Part No.	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22
Part 100	500	485	438	505	483	540	441	550	345
Part 101	175	170	153	177	169	189	154	193	200
Part 102	350	340	306	354	338	378	309	385	350
Part 103	890	863	779	899	859	961	785	979	885

FIGURE 2-2: Selecting the cells in the first column of the table with AutoSelect. (Sample workbook: Production Schedule 2022.xlsx)



Production Schedule for 2022

Part No.	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22
Part 100	500	485	438	505	483	540	441	550	345
Part 101	175	170	153	177	169	189	154	193	200
Part 102	350	340	306	354	338	378	309	385	350
Part 103	890	863	779	899	859	961	785	979	885

FIGURE 2-3: Selecting all the remaining columns of the table with AutoSelect. (Sample workbook: Production Schedule 2022.xlsx)

If you select the cells in the first row of the table (range A2:J2) in the first operation, you can then extend this range down the remaining rows of the table by double-clicking the bottom edge of one of the selected cells. (It doesn't matter which one.)

To use the AutoSelect feature with the keyboard, press the End key and one of the four arrow keys as you hold down the Shift key. When you hold down Shift and press End and an arrow key, Excel extends the selection in the direction of the arrow key to the first cell containing a value that is bordered by a blank cell.

In terms of selecting the table of data shown in Figures 2-2 and 2-3, this means that you would have to complete the following steps to select all of its cells:

1. **With A2 as the active cell, hold down Shift and press End + ↓ to select the range A2:A6.**

   Excel stops at A6 because this is the last occupied cell in that column. At this point, the cell range A2:A6 is selected.

2. **Hold down Shift and then press End + →.**

   Excel extends the range all the way to column J (because the cells in column J contain entries bordered by blank cells). Now all the cells in the table (the cell range A2:J6) are selected.

Selecting cells with Go To

Although you usually use the Go To feature to move the cell cursor to a new cell in the worksheet, you can also use this feature to select a range of cells. On the Ribbon's Home tab, click the Find & Select button’s drop-down menu and then click Go To (or press Ctrl + G or F5). Excel displays a Go To dialog box similar to the one shown in Figure 2-4. To move the cell cursor to a particular cell, enter the cell address in the Reference text box and click OK. (Excel automatically lists the addresses of the last four cells or cell ranges that you specified in the Go To list box.)

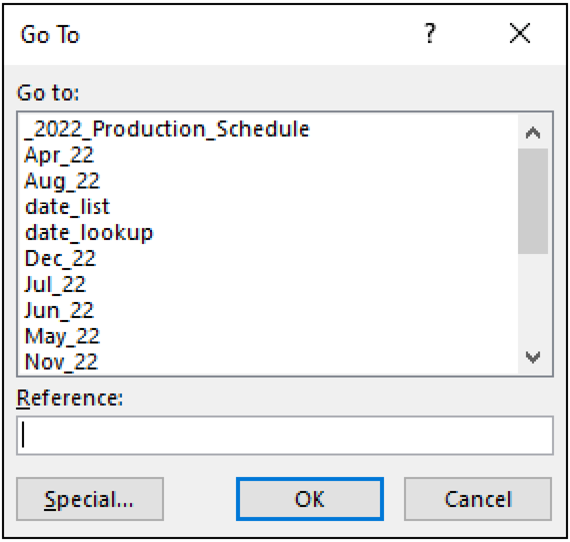

Go To
?
Go to:
_2022_Production_Schedule
Apr_22
Aug_22
date_list
date_lookup
Dec_22
Jul_22
Jun_22
May_22
Nov_22
Reference:
Special...
OK
Cancel

FIGURE 2-4: Selecting a cell range with the Go To dialog box.

Instead of just moving to a new section of the worksheet with the Go To feature, you can select a range of cells by taking these steps:

1. **Select the first cell of the range.**

   This becomes the active cell to which the cell range is anchored.

2. **On the Ribbon's Home tab, in the Editing group, click the Find & Select command and then click Go To from its drop-down menu or press Alt +HFDG, Ctrl+G, or F5.**

   The Go To dialog box opens.

3. **Type the cell address of the last cell in the range in the Reference text box.**

   If this address is already listed in the Go To list box, you can enter this address in the text box by clicking it in the list box.

4. **Hold down the Shift key as you click OK or press Enter to close the Go To dialog box.**

By holding down Shift as you click OK or press Enter, you select the range between the active cell and the cell whose address you specified in the Reference text box.

TIP

Instead of selecting the anchor cell and then specifying the last cell of a range in the Reference text box of the Go To dialog box, you can also select a range by typing the address of the cell range in the Reference text box. Remember that when you type a range address, you enter the cell reference of the first (active) cell and the last cell in the range separated by a colon. For example, to select the cell range that extends from cell B2 to G10 in the worksheet, you would type the range address **B2:G10** in the Reference text box before clicking OK or pressing Enter.

Name that range!

One of the easiest ways to select a range of data is to assign a name to it and then click that name on the pop-up menu attached to the Name box on the Formula bar or in the Go To list box in the Go To dialog box. Of course, you reserve this technique for cell ranges that you work with on a somewhat regular basis; for example, ranges with data that you print regularly, consult often, or have to refer to in formula calculations. It's probably not worth your while to name a range of data that doesn't carry any special importance in the worksheet.

To name a cell range, follow three simple steps:

1. **Select all the cells in the range that you intend to name.**

   You can use any of the cell selection techniques that you prefer. When selecting the cells for the named range, be sure to include all the cells that you want selected each time you select its range name.

2. **Click the Name box on the Formula bar.**

   Excel automatically highlights the address of the active cell in the selected range.

3. **Type the range name in the Name box and then press Enter.**

   As soon as you start typing, Excel replaces the address of the active cell with the range name that you're assigning. As soon as you press the Enter key, the name appears in the Name box instead of the cell address of the active cell in the range.

When naming a cell range, however, you *must* observe the following naming conventions:

- Begin the range name with a letter of the alphabet rather than a number or punctuation mark.
- Don't use spaces in the range name; instead, use an underscore between words in a range name (as in Qtr_1).
- Make sure that the range name doesn't duplicate any cell reference in the worksheet by using either the standard A1 or R1C1 notation system.
- Make sure that the range name is unique in the workbook.

The beauty of this method is that you can use it from anywhere in the same sheet or a different worksheet in the workbook because as soon as you click its name on the Name box pop-up menu, Excel takes you directly to the range, while at the same time automatically selecting all its cells.

REMEMBER Range names are also very useful when building formulas in your worksheet. For more on creating and using range names, see Book 3, Chapter 1.

TIP If you're using a touchscreen device without access to a mouse or physical keyboard, I can't recommend highly enough naming cell ranges that you regularly select for editing or printing in Excel. Tapping the range name on the

Name box's drop-down menu to select a large and distant cell range in a worksheet on the normally very small and cramped screen of a Windows tablet is so far superior to futzing with the cell's selection handles to select the range that it's just not funny!

Adjusting Columns and Rows

Along with knowing how to select cells for formatting, you really also have to know how to adjust the width of your columns and the heights of your rows. Why? Because often in the course of assigning different formatting to certain cell ranges (such as new font and font size in boldface type), you may find that data entries that previously fit within the original widths of their column no longer do and that the rows that they occupy seem to have changed height all on their own.

In a blank worksheet, all the columns and rows are the same standard width and height. The actual number of characters or pixels depends upon the aspect ratio of the device upon which you're running Excel. On most computer monitors, all Excel worksheet columns start out 8.47 characters wide (or 136 pixels at a 3240 x 2160 display resolution), and all rows start out 14.30 points high (or 38 pixels). On a smaller touchscreen, Excel worksheet columns start out at 8.09 characters wide (or 96 pixels, given their distinctive aspect ratio) with rows at 13.50 characters or 27 pixels high.

As you build your worksheet, you end up with all sorts of data entries that can't fit within these default settings. This is especially true as you start adding formatting to their cells to enhance and clarify their contents.

Most of the time, you don't need to be concerned with the heights of the rows in your worksheet because Excel automatically adjusts them up or down to accommodate the largest font size used in a cell in the row and the number of text lines (in some cells, you may wrap their text on several lines). Instead, you'll spend a lot more time adjusting the column widths to suit the entries for the formatting that you assign to them.

REMEMBER Remember what happens when you put a text entry in a cell whose current width isn’t long enough to accommodate all its characters. If the cells in columns to the right are empty, Excel lets the display of the extra characters spill over into the empty cells. If these cells are already occupied, however, Excel cuts off the display of the extra characters until you widen the column sufficiently. Likewise, remember that if you add formatting to a number so that its value and formatting can’t both be displayed in the cell, those nasty overflow indicators appear in the cell as a string of pound signs (#####) until you widen the column adequately.

Fitting the column to its contents automatically

The easiest way to adjust the width of a column to suit its longest entry is to use the AutoFit feature. AutoFit examines the content in the selected column or columns and then adjusts the width of each column so that it's just a bit wider than the column's longest entry.

- **To use AutoFit on a single column:** Position the mouse pointer on the right edge of that column in the column header and then, when the pointer changes to a double-headed arrow, double-click the mouse or double-tap your finger or stylus.
- **To use AutoFit on multiple columns at one time:** Select the columns by dragging through them in the column header or by Ctrl+clicking the column letters and then double-clicking the right edge of one of the selected columns when the pointer changes to a double-headed arrow.

These AutoFit techniques work well for adjusting all columns except for those that contain really long headings (such as the worksheet title that often spills over several blank columns in row 1), in which case AutoFit makes the columns far too wide for the bulk of the cell entries.

For those situations, use the AutoFit Column Width command, which adjusts the column width to suit only the entries in the cells of the column that you have selected. This way, you can select all the cells except for any really long ones in the column that purposely spill over to empty cells on the right, and then have Excel adjust the width to suit. Select the cells in the column that you want the new width to fit, click the Home tab, click the Format button in the Cells group, and then click AutoFit Column Width (or press Alt+HOI).

Adjusting columns the old-fashioned way

AutoFit is nothing if not quick and easy. If you need more precision in adjusting your column widths, you have to do this manually either by dragging its border with the mouse or by entering new values in the Column Width dialog box.

- **To manually adjust a column width with the mouse:** Drag the right edge of that column onto the Column header to the left (to narrow) or to the right (to widen) as required. As you drag the column border, a ScreenTip appears above the mouse pointer indicating the current width in both characters and pixels. When you have the column adjusted to the desired width, release the mouse button to set it.
- **To manually adjust a column width by touch:** Tap the right edge of the column header with your finger or stylus to select the column and make the black, double-header pointer appear. Then swipe the pointer left or right as needed. As you swipe, the Name box on the Formula bar indicates the current width in characters and pixels. When you have the column adjusted to the desired width, remove your finger or stylus from the touchscreen.

  TIP To make this operation easier, remember that you can instantly zoom in on the column border by stretching your forefinger and thumb on the touchscreen — doing this makes the column letter area larger, making it a lot easier to tap and swipe the border left and right with your finger or stylus.
- **To adjust a column width in the Column Width dialog box:** Position the cell pointer in any one of the cells in the column that you want to adjust, click the Home tab, click the Format button in the Cells group, and then click Column Width to open the Column Width dialog box (or press Alt+HOW). Enter the new width (in the number of characters between 0 and 255) in the Column Width text box and then click OK.

TIP You can apply a new column width that you set in the Column Width dialog box to more than a single column by selecting the columns (either by dragging through their letters on the Column header or holding down Ctrl as you click them) before you open the Column Width dialog box.

Setting a new standard width

You can use the Default Standard Width command to set all the columns in a worksheet to a new uniform width (other than the default 8.43 or 8.09 characters). To do so, click the Home tab, click the Format button in the Cells group, and then click Default Width (or press Alt +HOD). Doing this opens the Standard Width dialog box where you can replace the default value in the Standard Column Width text box with your new width (in characters) and then click OK or press Enter.

REMEMBER Note that when you set a new standard width for the columns of your worksheet, this new width doesn't affect any columns whose width you've previously adjusted either with AutoFit or in the Column Width dialog box.

Hiding out a column or two

You can use the Hide command to temporarily remove columns of data from the worksheet display. When you hide a column, you're essentially setting the column width to 0. Hiding columns enables you to remove the display of sensitive or supporting data that needs to be in the worksheet but may not be appropriate when you share your screen with others.

To hide a column, put the cell pointer in a cell in that column; to hide more than one column at a time, select the columns either by dragging through their letters on the Column header or by holding down Ctrl as you click them. Click the Home tab, click the Format button in the Cells group, and then choose Hide & Unhide ⇒ Hide Columns (or you can just press Alt+HOUC).

Excel lets you know that certain columns are missing from the worksheet by removing their column letters from the Column header so that if, for example, you hide columns D and E in the worksheet, column C is followed by column F on the Column header.

To restore hidden columns to view, select the visible columns on either side of the hidden one(s) — indicated by the missing letter(s) on the column headings — and then click the Home tab, click the Format button in the Cells group, and then click Hide & Unhide ⇒ Unhide Columns (or press Alt + HOUL).

Because Excel also automatically selects all the redisplayed columns, you need to deselect these columns before you do any formatting or editing that will affect all their cells. To deselect the columns, click a single cell anywhere in the worksheet or select whatever cell range that you want to work with.

REMEMBER When you hide a column, the data in the cells in all its rows (1 through 1,048,576) are hidden (not just the ones you can see on your computer screen). This means that if you have some data in rows of a column that need printing and some in other rows of that same column that need concealing, you can't use the Hide command to remove their display until you've moved the cells with the data to be printed into a different column. (See Book 2, Chapter 5 for details.)

Rambling rows

The controls for adjusting the height of the rows in your worksheet parallel those that you use to adjust its columns. The big difference is that Excel always applies AutoFit to the height of each row so that even though you find an AutoFit Row Height option under Cell size on the Format button's drop-down menu, you won't find much use for it.

Instead, you'll probably end up manually adjusting the heights of rows with the mouse or by entering new height values and occasionally hiding rows with sensitive or potentially confusing data. Follow these instructions for each type of action:

- **To adjust the height of a row with the mouse:** Position the mouse on the lower edge of the row's border in the Row header and then drag up or down when the mouse pointer changes to a double-headed, vertical arrow. As you drag, a ScreenTip appears to the side of the pointer, keeping you informed of the height in characters and also in pixels. (Remember that 14.3 points or 38 pixels is the default height of all rows in a new worksheet at a 3240 x 2160 display resolution.)

- **To manually adjust the height of a row by touch:** Tap the lower edge of the row border with your finger or stylus to select the row and make the black, double-header pointer appear. Then swipe the pointer up or down as needed. As you swipe, the Name box on the Formula bar indicates the current row height in characters and pixels. When you have the row adjusted to the desired height, remove your finger or stylus from the touchscreen.

  TIP To make this operation easier, remember that you can instantly zoom in on the row border by stretching your forefinger and thumb on the touchscreen — doing this makes the row number area larger, making it a lot easier to tap and swipe the border up and down with your finger or stylus.

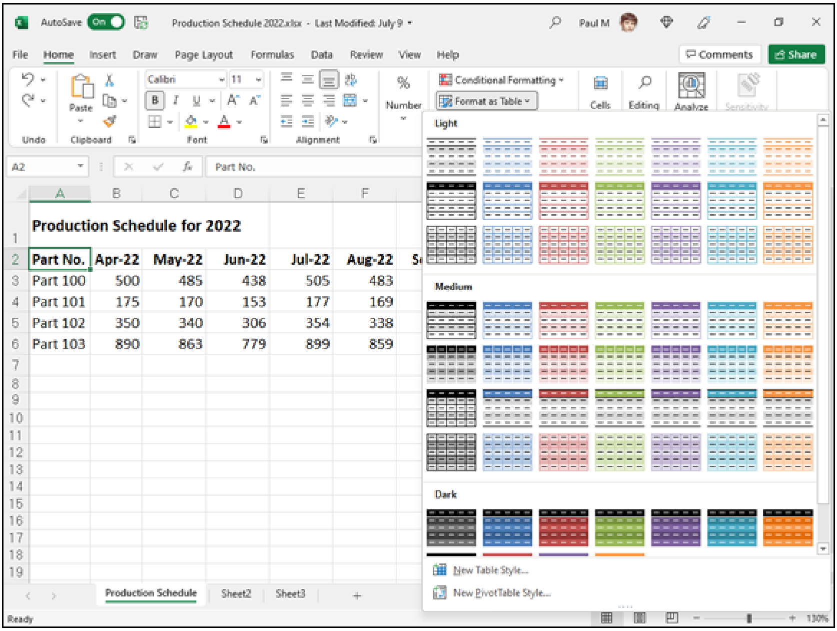
- **To change the height of a row in the Row Height dialog box:** Click the Home tab, click the Format button in the Cells group, and then click Row Height (or press Alt+HOH). Enter the value for the new row height in the Row Height text box and then click OK.
- **To hide a row:** Position the cell cursor in any one of the cells in that row and then click the Home tab, click the Format button in the Cells group, and then click Hide & Unhide ⇒ Hide Rows from the drop-down menu (or press Alt+HOUR). To then restore the rows that you currently have hidden in the worksheet, select the rows above and below the hidden rows, click the Home tab, click the Format button, and then click Hide & Unhide ⇒ Unhide Rows (or press Alt+HOUO, instead).

REMEMBER As with adjusting columns, you can change the height of more than one row and hide multiple rows at the same time by selecting the rows before you drag one of their lower borders, open the Row Height dialog box, or choose Format ⇒ Hide & Unhide ⇒ Hide Rows on the Home tab, or press Alt +HOUR.

Formatting Tables from the Ribbon

Excel’s Format as Table feature enables you to both define an entire range of data as a table and format all its data all in one operation. After you define a cell range as a table, you can completely modify its formatting by clicking a new style thumbnail in the Table Styles gallery. Excel also automatically extends this table definition — and consequently its table formatting — to all the new rows you insert within the table and add at the bottom as well as any new columns you insert within the table or add to either the table’s left or right end.

The Format as Table feature is so automatic that, to use it, you position the cell pointer somewhere within the range of data, and then click the Home tab's Format as Table command. Excel opens its rather extensive Table Styles gallery with the formatting thumbnails divided into three sections — Light, Medium, and Dark — each of which describes the intensity of the colors used by its various formats. (See Figure 2-5.)


AutoSave On
Production Schedule 2022.xlsx - Last Modified: July 9
Paul M
File
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Help
Comments
Share
Undo
Clipboard
Font
Alignment
Number
Conditional Formatting
Format as Table
Cells
Editing
Analyze
Sensitivity
Light
Medium
Dark
New Table Style...
New PivotTable Style...
Production Schedule
Sheet2
Sheet3
Ready
130%

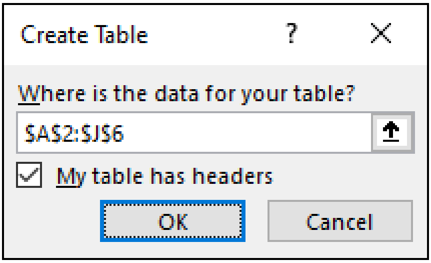
A2 Part No.

Production Schedule for 2022

Part No.	Apr-22	May-22	Jun-22	Jul-22	Aug-22
Part 100	500	485	438	505	483
Part 101	175	170	153	177	169
Part 102	350	340	306	354	338
Part 103	890	863	779	899	859

FIGURE 2-5: Selecting a format for the new table in the Table Styles gallery.

When you click one of the table formatting thumbnails in the Table Styles gallery, Excel makes its best guess as to the cell range of the table to apply it to (indicated by the marquee around its perimeter), and the Create Table dialog box similar to the one shown in Figure 2-6 appears.


Create Table
?
OK
Cancel

Where is the data for your table?

$A$2:$J$6

☑ My table has headers

FIGURE 2-6: Indicating the range of the table in the Create Table dialog box after selecting the style of table format.

This dialog box contains a Where Is the Data for Your Table? text box that shows the address of the cell range currently selected by the marquee and a My Table Has Headers check box (selected by default).

If Excel does not correctly guess the range of the data you want to format, drag through the cell range to adjust the marquee and the range address in the Where Is the Data for Your Table? text box. If your data doesn't use column headers, deselect the My Table Has Headers check box. When you click OK, Excel adds its own column headings (Column1, Column2, Column3, and so forth) as the top row of the new table.

TECHNICAL STUFF The table formats in the Table Styles gallery aren't available if you select multiple nonadjacent cells before you click the Format as Table command. You can convert only one range of cell data into a table at a time.

After you click OK in the Create Table dialog box, Excel applies the format of the thumbnail you clicked in the gallery to the range, and the command buttons on the Table Design tab appear on the Ribbon. (See Figure 2-7; sample workbook: Production Schedule 2022.xlsx.)

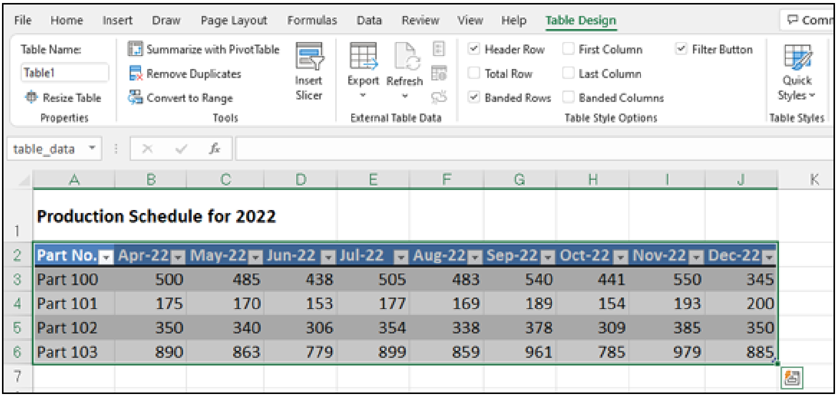

File
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Help
Table Design
Comm
Summarize with PivotTable
Remove Duplicates
Convert to Range
Tools
Insert Slicer
Export
Refresh
External Table Data
Quick Styles
Table Styles
Properties
Resize Table
Table Style Options
A
B
C
D
E
F
G
H
I
J
K

Table Name:
Table1

☑ Header Row
☐ Total Row
☑ Banded Rows
☐ First Column
☐ Last Column
☐ Banded Columns
☑ Filter Button

table_data

Production Schedule for 2022

Part No.	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22
Part 100	500	485	438	505	483	540	441	550	345
Part 101	175	170	153	177	169	189	154	193	200
Part 102	350	340	306	354	338	378	309	385	350
Part 103	890	863	779	899	859	961	785	979	885

FIGURE 2-7: After you select an initial table format, the Table Design tab appears. (Sample workbook: Production Schedule 2022.xlsx)

REMEMBER As you can see in Figure 2-7, when Excel defines a range as a table, it automatically adds AutoFilter drop-down buttons to each of the column headings (the little buttons with a triangle pointing downward in the lower-right corner of the cells with the column labels). To hide these AutoFilter buttons, click the Data tab's Filter button or press Alt+AT. (You can always redisplay them by clicking the Data tab's Filter button or by pressing Alt+AT a second time.)

The Table Design contextual tab enables you to use the Live Preview feature to see how your table data would appear in other table styles. Click the Quick Styles button and then highlight any of the format thumbnails in the gallery with the mouse or Touch pointer to see the data in your table appear temporarily in that table format.

The Table Design tab also contains a Table Style Options group you can use to further customize the look of the selected format. The Table Style Options group contains the following check boxes:

- **Header Row:** Toggles the header row of the table.
- **Total Row:** Add a Total row to the bottom of the table that displays the sum of the last column of the table (assuming that it contains values). To apply a Statistical function other than Sum to the values in a particular column of the new Total row, click the cell in that column’s Total row. Doing this displays a drop-down list — None, Average, Count, Count Numbers, Max, Min, Sum, StdDev (Standard Deviation), Var (Variance), or More Functions — on which you click the new function to use.
- **Banded Rows:** Apply shading to every other row in the table.
- **First Column:** Display the row headings in the first row of the table in bold.
- **Last Column:** Display the row headings in the last row of the table in bold.
- **Banded Columns:** Apply shading to every other column in the table.

REMEMBER Whenever you assign a format in the Table Styles gallery to one of the tables in your workbook, Excel automatically assigns that table a generic range name (Table1, Table2, and so on). You can use the Table Design tab's Table Name text box (it's in the Properties group) to rename the table with a more descriptive name.

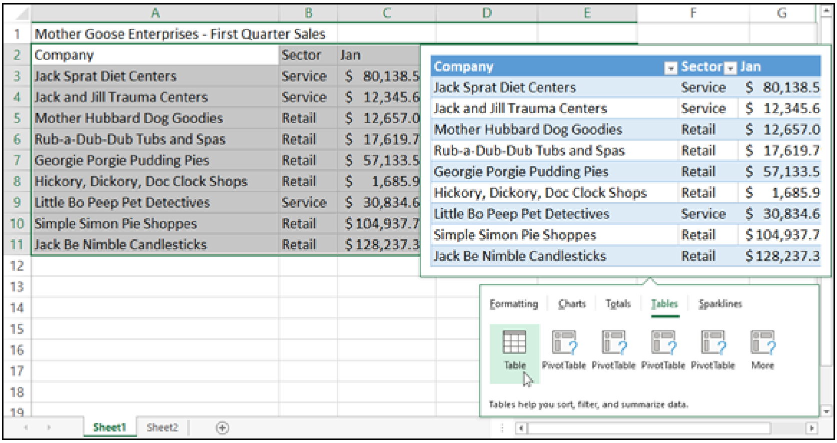
TIP

When you finish selecting and/or customizing the formatting of your table, click a cell outside of the table to remove the Table Design contextual tab from the Ribbon. If you later decide that you want to further experiment with the table's formatting, click any of the table's cells to redisplay the Table Design contextual tab at the end of the Ribbon.

Formatting Tables with the Quick Analysis Tool

You can use Excel's handy Quick Analysis tool to quickly format a range of data as a new table. Select all the cells in the range, including the cells in the first row with the column headings. The Quick Analysis tool appears in the lower-right corner of the cell selection (the outlined button with the lightning bolt striking the selected data icon). Click this tool to open the Quick Analysis options palette, which displays five tabs (Formatting, Charts, Totals, Tables, and Sparklines).

Click the Tables tab in the Quick Analysis tool's option palette to display its Table and PivotTable buttons. When you move the mouse pointer over the Table button on the Tables tab, Excel's Live Preview shows you how the selected data will appear formatted as a table. Figure 2-8 shows an example (sample workbook: MGE Q1 Sector Sales.xlsx). To apply this previewed formatting and format the selected cell range as a table, you only have to click the Table button.



	A	B	C
1	Mother Goose Enterprises - First Quarter Sales		
2	Company	Sector	Jan
3	Jack Sprat Diet Centers	Service	$ 80,138.5
4	Jack and Jill Trauma Centers	Service	$ 12,345.6
5	Mother Hubbard Dog Goodies	Retail	$ 12,657.0
6	Rub-a-Dub-Dub Tubs and Spas	Retail	$ 17,619.7
7	Georgie Porgie Pudding Pies	Retail	$ 57,133.5
8	Hickory, Dickory, Doc Clock Shops	Retail	$ 1,685.9
9	Little Bo Peep Pet Detectives	Service	$ 30,834.6
10	Simple Simon Pie Shoppes	Retail	$104,937.7
11	Jack Be Nimble Candlesticks	Retail	$128,237.3

Company	Sector	Jan
Jack Sprat Diet Centers	Service	$ 80,138.5
Jack and Jill Trauma Centers	Service	$ 12,345.6
Mother Hubbard Dog Goodies	Retail	$ 12,657.0
Rub-a-Dub-Dub Tubs and Spas	Retail	$ 17,619.7
Georgie Porgie Pudding Pies	Retail	$ 57,133.5
Hickory, Dickory, Doc Clock Shops	Retail	$ 1,685.9
Little Bo Peep Pet Detectives	Service	$ 30,834.6
Simple Simon Pie Shoppes	Retail	$104,937.7
Jack Be Nimble Candlesticks	Retail	$128,237.3

Tables help you sort, filter, and summarize data.

FIGURE 2-8: Previewing the selected data formatted as a table with the Quick Analysis tool. (Sample workbook: MGE Q1 Sector Sales.xlsx)

When you click the Table button, the Quick Analysis options palette disappears, Excel converts the range to a table, and the Table Design contextual tab appears on the Ribbon. You can then use its Quick Styles drop-down gallery to select a different formatting style for your table. (The Tables button on the Quick Analysis tool's Tables tab offers only the one blue medium style shown in the Live Preview.)

Formatting Cells from the Ribbon

Some worksheet data require a lighter touch than formatting as a table offers. For example, you may have a range where the only emphasis you want to add is to apply bold to a row of headings at the top of the range and to underline a row of totals at the bottom (done by drawing a borderline along the bottom of the cells).

In the Ribbon's Home tab, the formatting buttons that appear in the Font, Alignment, and Number groups enable you to accomplish just this kind of targeted cell formatting. See Table 2-1 for a complete rundown on the use of each of these formatting buttons.

TABLE 2-1 The Formatting Command Buttons in the Home Tab's Font, Alignment, and Number Groups

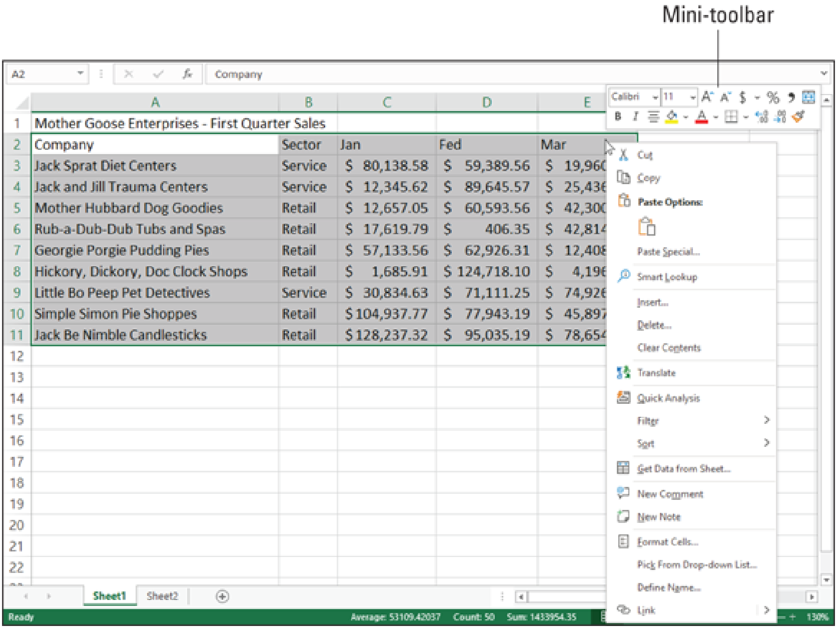
Group	Button Name	Function	Hot Keys
Font	Aptos	Displays a Font drop-down menu from which you can assign a new font for the entries in your cell selection.	

Font Size	Alt+HFS	Displays a Font Size drop-down menu from which you can assign a new font size to the entries in your cell selection. Click the Font Size text box and enter the desired point size if it doesn't appear on the drop-down menu.
Increase Font Size	Alt+HFG	Increases the font size of the entries in your cell selection.
Decrease Font Size	Alt+HFK	Decreases the font size of the entries in your cell selection.
Bold	Alt+H1	Applies and removes boldface in the entries in your cell selection.
Italic	Alt+H2	Applies and removes italics in the entries in your cell selection.
Underline	Alt+H3U (single) or Alt+H3D (for double)	Applies and removes underlining in the entries in your cell selection.
Borders	Alt+HB	Opens a Borders drop-down menu from which you can assign a new border style to or remove an existing border style from your cell selection.
Fill Color	Alt+HH	Opens a drop-down Color palette from which you can assign a new background color for your cell selection.
Font Color	Alt+HFC	Opens a drop-down Color palette from which you can assign a new font color for the entries in your cell selection.
Alignment		
Top Align	Alt+HAT	Aligns the entries in your cell selection with the top border of their cells.
Middle Align	Alt+HAM	Vertically centers the entries in your cell selection between the top and bottom borders of their cells.
Bottom Align	Alt+HAB	Aligns the entries in your cell selection with the bottom border of their cells.
Orientation	Alt+HFQ	Opens a drop-down menu with options for changing the angle and direction of the entries in your cell selection.
Wrap Text	Alt+HW	Wraps the entries in your cell selection that spill over their right borders onto multiple lines within the current column width.
Align Left	Alt+HAL	Aligns the entries in your cell selection with the left edge of their cells.
Center	Alt+HAC	Centers all the entries in your cell selection within their cells.
Align Right	Alt+HAR	Aligns the entries in your cell selection with the right edge of their cells.
Decrease Indent	Alt+H5 or Ctrl+Alt+Shift+Tab	Decreases the margin between entries in your cell selection and their left cell borders by one character.
Increase Indent	Alt+H6 or Ctrl+Alt+Tab	Increases the margin between the entries in your cell selection and their left cell borders by one character.
Merge & Center	Alt+HMC	Merges your cell selection into a single cell and then centers the combined entry in the first cell between its new left and right borders. Click the Merge and Center drop-down button to display a menu of options that enable you to merge the cell selection into a single cell without centering the entries, as well as to split up a merged cell back into its original individual cells.
Number		
Number Format	Alt+HN	Displays the number format applied to the active cell in your cell selection. Click its drop-down button to open a drop-down menu where you can assign one of Excel's major Number formats to the cell selection.
Accounting Number Format	Alt+HAN	Opens a drop-down menu from which you can select the currency symbol to be used in the Accounting number format. When you select the $ English (United States) option, this format adds a dollar sign, uses commas to separate thousands, displays two decimal places, and encloses negative values in a closed pair of parentheses. Click More Accounting Formats to open the Number tab of the Format Cells dialog box where you can customize the number of decimal places and/or currency symbol used.
Percent Style	Alt+HP	Formats your cell selection using the Percent Style number format, which multiplies the values by 100 (for display purposes only) and adds a percent sign with no decimal places.
Comma Style	Alt+HK	Formats your cell selection with the Comma Style Number format, which uses commas to separate thousands, displays two decimal places, and encloses negative values in a pair of parentheses.
Increase Decimal	Alt+H0 (zero)	Adds a decimal place to the values in your cell selection.
Decrease Decimal	Alt+H9	Removes a decimal place from the values in your cell selection.

REMEMBER Don't forget the shortcut keys: Ctrl+B for toggling bold in the cell selection, Ctrl+I for toggling italics, and Ctrl+U for toggling underlining.

Formatting Cell Ranges with the Mini-Toolbar

Excel makes it easy to apply common formatting changes to a cell selection right within the Worksheet area thanks to its mini-toolbar feature. To display the mini-toolbar, select the cells that need formatting and then right-click somewhere in the cell selection. The mini-toolbar then appears immediately below or above the cell selection's shortcut menu. (See Figure 2-9.)


Mini-toolbar
A2
Company
Calibri
11
B
I
Cut
Copy
Paste Options:
Paste Special...
Smart Lookup
Insert...
Delete...
Clear Contents
Translate
Quick Analysis
Filter
Sort
Get Data from Sheet...
New Comment
New Note
Format Cells...
Pick From Drop-down List...
Define Name...
Link
Sheet1
Sheet2
Ready
Average: 53109.42037
Count: 50
Sum: 1433954.35
130%

	A	B	C	D	E
1	Mother Goose Enterprises - First Quarter Sales				
2	Company	Sector	Jan	Fed	Mar
3	Jack Sprat Diet Centers	Service	$ 80,138.58	$ 59,389.56	$ 19,96
4	Jack and Jill Trauma Centers	Service	$ 12,345.62	$ 89,645.57	$ 25,43
5	Mother Hubbard Dog Goodies	Retail	$ 12,657.05	$ 60,593.56	$ 42,30
6	Rub-a-Dub-Dub Tubs and Spas	Retail	$ 17,619.79	$ 406.35	$ 42,81
7	Georgie Porgie Pudding Pies	Retail	$ 57,133.56	$ 62,926.31	$ 12,40
8	Hickory, Dickory, Doc Clock Shops	Retail	$ 1,685.91	$ 124,718.10	$ 4,19
9	Little Bo Peep Pet Detectives	Service	$ 30,834.63	$ 71,111.25	$ 74,92
10	Simple Simon Pie Shoppes	Retail	$ 104,937.77	$ 77,943.19	$ 45,89
11	Jack Be Nimble Candlesticks	Retail	$ 128,237.32	$ 95,035.19	$ 78,65

FIGURE 2-9: Right-click your cell selection to display its shortcut menu along with the mini-bar, which you can use to format the selection.

The mini-toolbar contains most of the buttons from the Home tab's Font group (with the exception of the Underline button). It also contains the Center button and the Merge & Center button from the Alignment group (see "Altering the alignment" later in this chapter), and the Accounting Number Format, Percent Style, Comma Style, Increase Decimal, and Decrease Decimal buttons from the Number group. Click these buttons to apply their formatting to the current cell selection.

The mini-toolbar also contains the Format Painter button from the Clipboard group of the Home tab, which you can use to copy the formatting in the active cell to a cell selection you make. (See "Hiring Out the Format Painter" later in this chapter for details.)

TIP To display the mini-toolbar on a touchscreen device, tap and hold any cell in the selected range with your finger. Note that the mini-toolbar that appears is different than the one you see when you right-click a cell selection with a physical mouse. The touchscreen mini-toolbar contains a single row of command buttons that combine editing and formatting functions — Paste, Cut, Copy, Clear, Fill Color, Font Color, and AutoFill followed by a Show Context Menu button (with a black triangle pointing downward). Tap the Show Context Menu button to display a pop-up menu of other editing and formatting options. Tap the Format Cells button on this menu to get access to all sorts of formatting options (see the section that follows for details).

Note that if your device has a stylus, tapping and holding a cell in the selected cell range displays the standard mini-toolbar just as though you were using a mouse.

Using the Format Cells Dialog Box

Although the command buttons in the Home tab's Font, Alignment, and Number groups give you immediate access to the most commonly used formatting commands, they don't represent all of Excel's formatting commands by any stretch of the imagination.

To access all the formatting commands, you need to open the Format

Cells dialog box using any of the following methods:

- Click the dialog box launcher that appears in the lower-right corner of the Home tab's Font, Alignment, or Number tab.
- In the Home tab's Cells group, choose Format ⇒ Format Cells.
- Press Ctrl + 1 or Alt + HOE.

The Format Cells dialog box contains six tabs: Number, Alignment, Font, Border, Fill, and Protection. (In this chapter, I show you how to use them all except the Protection tab; for information on that tab, see Book 4, Chapter 1.)

Assigning number formats

When you enter numbers in a cell or a formula that returns a number, Excel doesn't change whatever number format is already applied to the cell. If no number format is applied, then Excel uses the General number format. The General format displays numeric entries more or less as you enter them. However, the General format does make the following changes to your numeric entries:

- Drops any trailing zeros from decimal fractions so that **4.5** appears when you enter **4.50** in a cell.
- Drops any leading zeros in whole numbers so that **7** appears when you enter **007** in a cell.
- Inserts a zero before the decimal point in any decimal fraction without a whole number so that **0.123** appears when you enter **.123** in a cell.
- Truncates decimal places in a number to display the whole numbers in a cell when the number contains too many digits to be displayed in the current column width. It also converts the number to scientific notation when the column width is too narrow to display all integers in the whole number.

Remember that you can always override the General number format when you enter a number by entering the characters used in recognized number formats. For example, to enter the value 2500 and assign it the Currency number format that displays two decimal places, you enter **$2,500.00** in the cell.

Note that although you can override the General number format and assign one of the others to any numeric value that you enter into a cell, you can’t do this when you enter a formula into a cell. To apply another format to a calculated result, select a format using the buttons in the Home tab's Number group, or use the Number tab of the Format Cells dialog box. I discuss the latter in more detail in the sections that follow.

Using one of the predefined number formats

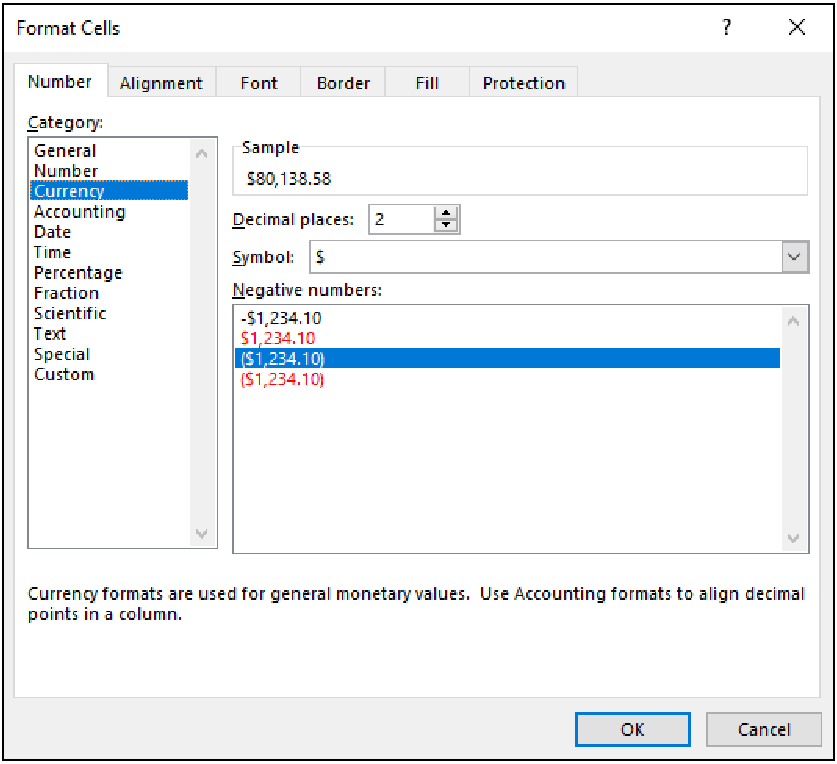
When you first open the Format Cells dialog box with a range of newly entered data selected, the General category of number formats is highlighted in the Category list box with the words “General format cells have no specific number format” showing in the area to the right. Directly above this cryptic message (which is Excel-speak for “We don’t care what you’ve put in your cell; we’re not changing it!”) is the Sample area. This area shows how the number in the active cell appears in whatever format you choose. (This is blank if the active cell is blank or if it contains text instead of a number.)

TECHNICAL STUFF

WHAT YOU SEE IS NOT ALWAYS WHAT YOU GET

The number format that you assign to cells with numeric entries in the worksheet affects *only* the way they are displayed in their cells and not their underlying values. For example, if a formula returns the value 3.456789 in a cell and you apply a number format that displays only two decimal places, Excel displays the value 3.46 in the cell. If you then refer to the cell in a formula that multiplies its value by 2, Excel returns the result 6.913578 instead of the result 6.92, which would be the result if Excel was actually multiplying 3.46 by 2. If you want to modify the rounded value in a cell, you use the ROUND function. (See Book 3, Chapter 5 for details.)

When you click the Number, Currency, Accounting, or Percentage category in the Category list box, more options appear in the area just to the right of the Category list box in the form of different check boxes, list boxes, and spinner buttons. (Figure 2-10 shows the Format Cells dialog box when Currency is selected in the Category list.) These options determine how you want items such as decimal places, dollar signs, comma separators, and negative numbers to be used in the format category that you’ve chosen.


Format Cells
?
Number
Alignment
Font
Border
Fill
Protection
General
Number
Currency
Accounting
Date
Time
Percentage
Fraction
Scientific
Text
Special
Custom
-$1,234.10
$1,234.10
($1,234.10)
($1,234.10)
OK
Cancel

Category: Currency

Sample
$80,138.58

Decimal places: 2

Symbol: $

Negative numbers: ($1,234.10)

Currency formats are used for general monetary values. Use Accounting formats to align decimal points in a column.

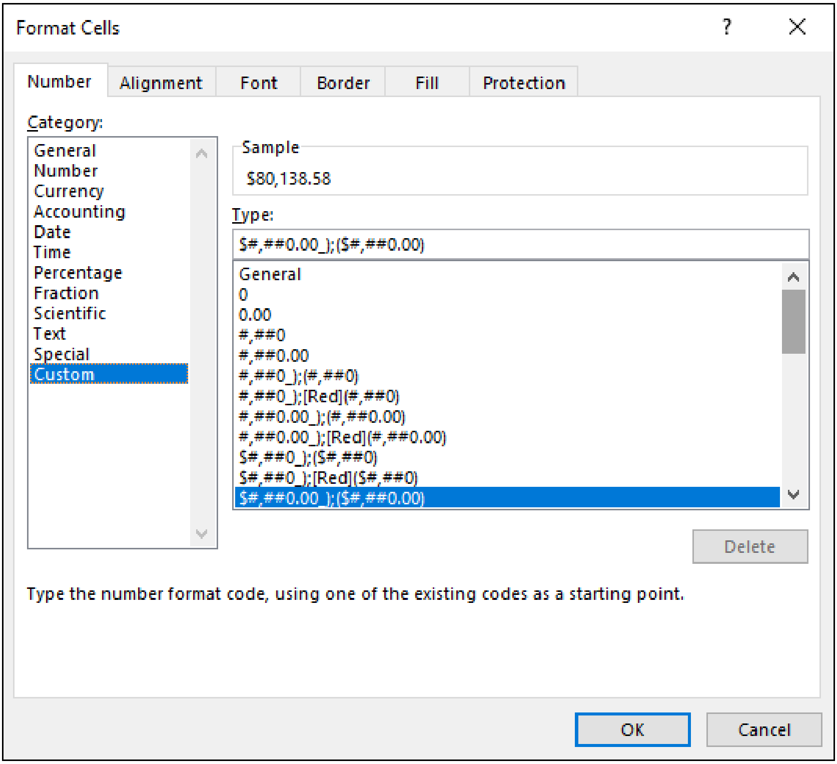
FIGURE 2-10: Options for customizing the formatting assigned by the Currency number format.

When you choose the Date, Time, Fraction, Special, or Custom category, a large Type list box appears that contains handfuls of predefined category types, which you can apply to your value to change its appearance. Just like when you're selecting different formatting categories, the Sample area of the Format Cells dialog box shows you how the various category *types* will affect your selection.

I should note here that Excel always tries to choose an appropriate format category in the Category list box based on the way you entered your value in the selected cell. If you enter 3:00 in a cell and then open the Number tab of the Format Cells dialog box (Ctrl+1), Excel highlights the h:mm time format in the Custom category in the Type list box.

Deciphering the Custom number formats

You probably noticed while playing around selecting different formats in the Category list box that, for the most part, the different categories and their types are straightforward. For most people, that self-assured feeling goes right out the window as soon as they click the Custom category and get a load of its accompanying Type list box, shown in Figure 2-11. It starts off with the nice word *General,* then 0, then 0.00, and after that, things get *very* weird. Codes with 0s and #s (and other junk) start to appear, and it only goes downhill from there.



Format Cells
?
Number
Alignment
Font
Border
Fill
Protection
General
Number
Currency
Accounting
Date
Time
Percentage
Fraction
Scientific
Text
Special
Custom
General
0
0.00
#,##0
#,##0.00
#,##0_);(#,##0)
#,##0_);[Red](#,##0)
#,##0.00_);(#,##0.00)
#,##0.00_);[Red](#,##0.00)
$#,##0_);($#,##0)
$#,##0_);[Red]($#,##0)
$#,##0.00_);($#,##0.00)
Delete
OK
Cancel

Category: Custom

Sample: $80,138.58

Type: $#,##0.00_);($#,##0.00)

Type the number format code, using one of the existing codes as a starting point.

FIGURE 2-11: You can create your own number format using the Custom category in the Format Cells dialog box.

As you move down the list, the longer codes are divided into sections separated by semicolons and enclosed within square brackets. Although at first glance these codes appear as gibberish, you'll actually find that they're quite understandable. (Well, would you believe *useful,* then?)

And these codes *can* be useful, especially after you understand them. You can use them to create number formats of your own design. The basic keys to understanding number format codes are as follows:

- Excel number formats use a combination of the 0, ?, and # symbols (along with punctuation such as dollar signs, percent signs, and commas) to stand for the formatted digits in the numbers that you format.

- The 0 is a placeholder for a digit that tells Excel to display the digit exactly as it appears in the cell; if no digit appears for a particular 0 placeholder, Excel displays 0. For example, if the number format is 000.0 and the cell contains 12.3, you see 012.3 in the cell.
- The ? is used like the 0 except that it inserts spaces at the end as needed to make sure that values line up on the decimal point. For example, by entering the number format 0.??, such values as 10.5 and 24.71 line up with each other in their cells because Excel adds an extra space after the 5 to push it over to the left so that it's in line with the 7 of 71. If you used the number format 0.00 instead, these two values would not line up on the decimal point when they are right-aligned in their cells.
- The # symbol is a placeholder for a digit that tells Excel to display the digit exactly as it appears in the cell; if no digit appears for a particular # placeholder, Excel displays nothing. For example, if the number format is ###.## and the cell contains 12.3, you see 12.3 in the cell.
- The $ (dollar sign) symbol is added to the beginning of a number format if you want dollar signs to appear at the beginning of every formatted number.
- The % (percent sign) symbol is added to the end of the number format if you want Excel to actually transform the value into a percentage (multiplying it by 100 and adding a percent sign).

Number formats can specify one format for positive values, another for negative values, a third for zero values, and even a fourth format for text in the cells. In such complex formats, the format codes for positive values come first, followed by the codes for negative values, and a semicolon separates each group of codes. Any format codes for how to handle zeros and text in a cell come third and fourth, respectively, in the number format, again separated by semicolons. If the number format doesn't specify special formatting for negative or zero values, these values are automatically formatted like positive values. If the number format doesn't specify what to do with text, text is formatted according to Excel's default values. For example, look at the following number format:

```
#,##0_);(#,##0)
```

This particular number format specifies how to format positive values (the codes in front of the semicolon) and negative values (the codes after the semicolon). Because no further groups of codes exist, zeros are formatted like positive values, and no special formatting is applied to text.

If a number format puts negative values inside parentheses, the positive number format portion often pads the positive values with a space that is the same width as a right parenthesis. To indicate this, you add an underscore (by pressing Shift and the hyphen key) followed immediately by a closed parenthesis symbol. By padding positive numbers with a space equivalent to a right parenthesis, you ensure that digits of both positive and negative values line up in a column of cells.

You can assign different colors to a number format. For example, you can create a format that displays the values in green (the color of money!) by adding the code [GREEN] at the beginning of the format. A more common use of color is to display just the negative numbers in red (ergo the saying “in the red”) by inserting the code [RED] right after the semicolon separating the format for positive numbers from the one for negative numbers. Color codes include [BLACK], [BLUE], [CYAN], [GREEN], [MAGENTA], [RED], [WHITE], and [YELLOW].

Date number formats use a series of abbreviations for month, day, and year that are separated by characters, such as a dash (—) or a slash (/). The code m inserts the month as a number; mmm inserts the month as a three-letter abbreviation, such as Apr or Oct; and mmmm spells out the entire month, such as April or October. The code d inserts the date as a number; dd inserts the date as a number with a leading zero, such as 04 or 07; ddd inserts the date as a three-letter abbreviation of the day of the week, such as Mon or Tue; and dddd inserts the full name of the day of the week, such as Monday or Tuesday. The code yy inserts the last two digits of the year, such as 22 or 23; yyyy inserts all four digits of the year, such as 2022, 2023, and so on.

Time number formats use a series of abbreviations for the hour, minutes, and seconds. The code h inserts the number of the hour; hh inserts the number of the hour with leading zeros, such as 02 or 06. The code m inserts the minutes; the code mm inserts the minutes with leading zeros, such as 01 or 09. The code s inserts the number of seconds; ss inserts the seconds with leading zeros, such as 03 or 08. Add AM/PM or am/pm to have Excel tell time on a 12-hour clock, and add either AM (or am) or PM (or pm) to the time number depending on whether the date is before or after noon. Without these AM/PM codes, Excel displays the time number on a 24-hour clock, just like the military does. (For example, 2:00 PM on a 12-hour clock is expressed as 14:00 on a 24-hour clock.)

So that’s all you really need to know about making some sense of all those strange format codes that you see when you select the Custom category on the Number tab of the Format Cells dialog box.

Designing your own number formats

Armed with a little knowledge on the whys and wherefores of interpreting Excel number format codes, you're ready to see how to use these codes to create your own custom number formats. The reason for going through all that code business is that, to create a custom number format, you have to type your own codes.

To create a custom format, follow this series of steps:

1. **Open a worksheet and enter a sample of the values or text to which you will be applying the custom format.**

   If possible, apply the closest existing format to the sample value as you enter it in its cell. (For example, if you’re creating a derivative of a Currency format, enter it with the dollar sign, commas, and decimal points that you know you’ll want in the custom format.)

2. **Open the Format Cells dialog box and use its categories to apply the closest existing number format to the sample cell.**

3. **Click Custom in the Category list box and then edit the codes applied by the existing number format that you chose in the Type list box until the value in the Sample section appears exactly as you want it.**

What could be simpler? Ah, but Step 3, there’s the rub: editing weird format codes and getting them just right so that they produce exactly the kind of number formatting that you’re looking for!

Actually, creating your own number format isn’t as bad as it first sounds, because you “cheat” by selecting a number format that uses as many of the codes as possible that you need in the new custom number that you’re creating. Then you use the Sample area to keep a careful eye on the results as you edit the codes in the existing number format. For example, suppose that you want to create a custom date format to use on the current date that you enter with Excel’s built-in NOW()

function. (See Book 3, Chapter 3 for details.) You want this date format to display the full name of the current month (January, February, and so on), followed by two digits for the date and four digits for the year, such as November 06, 2022.

To do this, use the Insert Function button on the Formula bar to insert the NOW() function into a blank worksheet cell; then with this cell selected, open the Format Cells dialog box and scroll down through the Custom category Type list box on the Number tab until you see the date codes m/d/yyyy h:mm. Highlight these codes and then edit them as follows in the Type text box directly above:

```
mmmm dd, yyyy
```

The mmmm format code inserts the full name of the month in the custom format; dd inserts two digits for the day (including a leading zero, like 02 and 03); the yyyy code inserts the year. The other elements in this custom format are the space between the mmmm and dd codes and a comma and a space between the dd and yyyy codes (these being purely “punctuational” considerations in the custom format).

What if you want to do something even fancier and create a custom format that tells you something like “Today is Sunday, November 06, 2022” when you format a cell containing the NOW function? Well, you select your first custom format and add a little bit to the front of it, as follows:

```
"Today is" dddd, mmmm dd, yyyy
```

In this custom format, you’ve added two more elements: *Today is* and *dddd.* The Today is code tells Excel to enter the text between the quotation marks verbatim; the dddd code tells the program to insert the whole name of the day of the week. And you thought this was going to be a hard section!

Next, suppose that you want to create a really colorful number format — one that displays positive values in blue, negative values in red (what else?), zero values in green, and text in cyan. Further suppose that you want commas to separate groups of thousands in the values, no decimal places to appear (whole numbers only, please), and negative values to appear inside parentheses (instead of using that tiny little minus sign at the start). Sound complex? Hah, this is a piece of cake.

1. **In four blank cells in a new worksheet, enter** 1200 **in the first cell,** -8000 **in the second cell,** 0 **in the third cell, and the text**

Hello There! **in the fourth cell.**

2. **Select all four cells as a range (starting with the one containing 1200 as the first cell of the range).**
3. **Open the Format Cells dialog box and select the Number tab and Number in the Category list.**
4. **Click the #,##0_); [Red] (#,##0) code in the Custom category Type list box (it's the seventh set down from the top of the list box) and then edit it as follows:** [Blue]#,##0_);[Red](#,##0);[Green];[Cyan]**.**
5. **Click OK.**

That's all there is to that. When you return to the worksheet, the cell with 1200 appears in blue as 1,200, the -8000 appears in red as (8,000), the 0 appears in green, and the text "Hello There!" appears in a lovely cyan.

Before you move on, you should know about a particular custom format because it can come in really handy from time to time. I'm referring to the custom format that hides whatever has been entered in the cells. You can use this custom format to temporarily mask the display of confidential information used in calculating the worksheet before you print and distribute the worksheet. This custom format provides an easy way to avoid distributing confidential and sensitive information while protecting the integrity of the worksheet calculations at the same time.

To create a custom format that masks the display of the data in a cell selection, you create an "empty" format that contains just the semicolon separators in a row:

```
;;;
```

This is one custom format that you can probably type by yourself!

After creating this format, you can blank out a range of cells by selecting them and then selecting this three-semicolon custom format in the Format Cells dialog box. To bring back a cell range that's been blanked out with this custom format, select what now looks like blank cells and then select one of the other (visible) formats that are available. If the cell range contains text and values that normally should use a variety of different formats, first use General to make them visible. After the contents are back on display, format the cells in smaller groups or individually, as required.

Altering the alignment

You can access Excel’s Alignment options in two ways:

- Using the buttons in the Home tab's Alignment group
- Using the options on the Alignment tab of the Format Cells dialog box

Alignment refers to both the horizontal and vertical placement of the characters in an entry in relation to its cell boundaries as well as the orientation of the characters and how they are read. Horizontally, Excel automatically right-aligns all numeric entries and left-aligns all text entries in their cells (referred to as General alignment). Vertically, Excel aligns all types of cell entries with the bottom of their cells.

On the Alignment tab of the Format Cells dialog box, the Horizontal drop-down list offers you the following horizontal text alignment choices:

- **General** (the default) right-aligns a numeric entry and left-aligns a text entry in its cell.
- **Left (Indent)** left-aligns the entry in its cell and indents the characters from the left edge of the cell by the number of characters entered in the Indent combo box (which is 0 by default).
- **Center** centers any type of cell entry in its cell.
- **Right (Indent)** right-aligns the entry in its cell and indents the characters from the right edge of the cell by the number of characters entered in the Indent combo box (which is 0 by default).
- **Fill** repeats the entry until its characters fill the entire cell display. When you use this option, Excel automatically increases or decreases the repetitions of the characters in the cell as you adjust the width of its column. Fill is useful for creating dot leaders (that is, a series of dots that connect one cell with another).
- **Justify** spreads out a text entry with spaces so that the text is aligned with the left and right edges of its cell. If necessary to justify the text, Excel automatically wraps the text onto more than one line in the cell and increases the height of its row. If you use the Justify option on numbers, Excel left-aligns the values in their cells just as if you had selected the Left align option.
- **Center Across Selection** centers a text entry over selected blank

cells in columns to the right of the cell entry.

- **Distributed (Indent)** indents the text in from the left and right cell margins by the amount you enter in the Indent text box or select with its spinner buttons (which appear when you select this option from the Horizontal drop-down list) and then distributes the text evenly in the space in between.

For text entries in the worksheet, you can also add the Wrap Text check box option to any of the horizontal alignment choices. (Note that you can also access this option in the Home tab's Alignment group by clicking the Wrap Text button.) When you select the Wrap Text option, Excel configures the text entry to display on multiple lines within its cell while maintaining the type of alignment that you’ve selected (something that automatically happens when you select the Justify alignment option).

Instead of wrapping text that naturally increases the row height to accommodate the additional lines, you can use the Shrink to Fit check box option on the Alignment tab of the Format Cells dialog box to have Excel reduce the size of the text in the cell sufficiently so that all its characters fit within their current column widths.

In addition, Excel offers the following vertical text alignment options from the Vertical drop-down list:

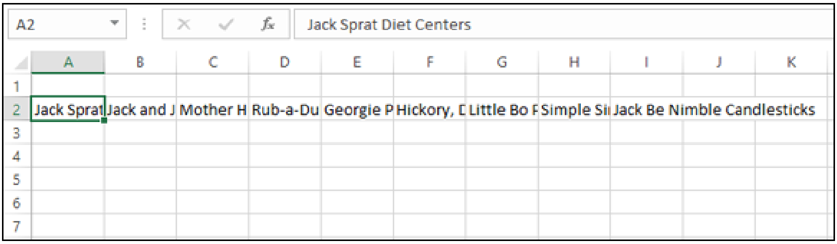
- **Top** aligns any type of cell entry with the top edge of its cell.
- **Center** centers any type of cell entry between the top and bottom edges of its cell.
- **Bottom** (the default) aligns any type of cell entry with the bottom edge of its cell.
- **Justify** wraps the text of a cell entry on different lines spread out with blank space so that they are vertically aligned between the top and bottom edges of the cell.
- **Distributed** wraps the text of the cell entry on different lines distributed evenly between the top and bottom edges of its cell.

Finally, as part of its alignment options, Excel lets you alter the *orientation* (the angle of the characters in a cell entry) and *text direction* (the way the characters are read). The direction is left-to-right for European languages and right-to-left for some languages, such as Hebrew and Arabic. (Chinese characters can also sometimes be read from right to left, as well.)

Wrapping text entries to new lines in their cells

You can use the Wrap Text button on the Ribbon's Home tab or the Wrap Text check box in the Text Control section of the Alignment tab to have Excel create a multi-line entry from a long text entry that would otherwise spill over to blank cells to the right. In creating a multi-line entry in a cell, the program also automatically increases the height of its row if that's required to display all the text.

To get an idea of how text wrap works in cells, compare Figures 2-12 and 2-13 (sample workbook: MGE Q1 Sector Sales.xlsx for both). Figure 2-12 shows you a row of long text entries that spill over to succeeding blank cells in columns to the right. Figure 2-13 shows you these same entries after they have been formatted with the Wrap Text option. The first long text entry is in cell A2 and the last in cell I2. They all use General alignment (same as Left for text) with the Wrap Text option.

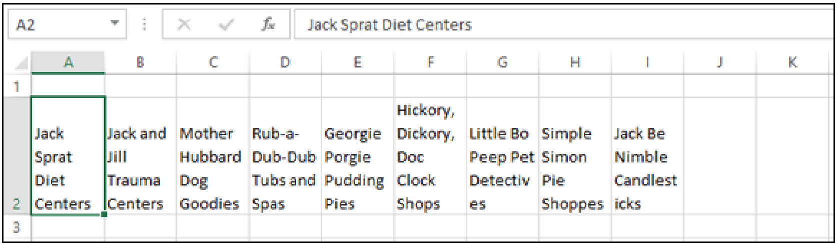


Jack Sprat Diet Centers

	A	B	C	D	E	F	G	H	I	J	K
1											
2	Jack Sprat	Jack and J	Mother H	Rub-a-Du	Georgie P	Hickory, D	Little Bo F	Simple Si	Jack Be Nimble Candlesticks		
3											
4											
5											
6											
7											

FIGURE 2-12: Worksheet with long text entries that spill over into blank cells on the right. (Sample workbook: MGE Q1 Sector Sales.xlsx)

When you create multi-line text entries with the Wrap Text option, you can decide where each line breaks by inserting a new paragraph. To do this, you put Excel in Edit mode by clicking the insertion point in the Formula bar at the place where a new line should start and pressing Alt +Enter. When you press the Enter key to return to Ready mode, Excel inserts an invisible paragraph marker at the insertion point that starts a new line both on the Formula bar and within the cell with the wrapped text.



A2 | Jack Sprat Diet Centers

	A	B	C	D	E	F	G	H	I	J	K
1											
2	Jack Sprat Diet Centers	Jack and Jill Trauma Centers	Mother Hubbard Dog Goodies	Rub-a-Dub-Dub Tubs and Spas	Georgie Porgie Pudding Pies	Hickory, Dickory, Doc Clock Shops	Little Bo Peep Pet Detectives	Simple Simon Pie Shoppes	Jack Be Nimble Candlesticks		
3											

FIGURE 2-13: Worksheet after wrapping long text entries in their cells, increasing the height of their rows. (Sample workbook: MGE Q1 Sector Sales.xlsx)

TIP

If you ever want to remove the paragraph marker and rejoin text split on different lines, click the insertion point at the beginning of the line that you want to join on the Formula bar and press the Backspace key.

Reorienting your entries

You can change the *orientation* (that is, the angle of the baseline on which the characters rest) of the characters in a cell entry by rotating up or down the baseline of the characters.

On the Home tab, the Alignment group's Orientation command button contains the following options on its drop-down menu:

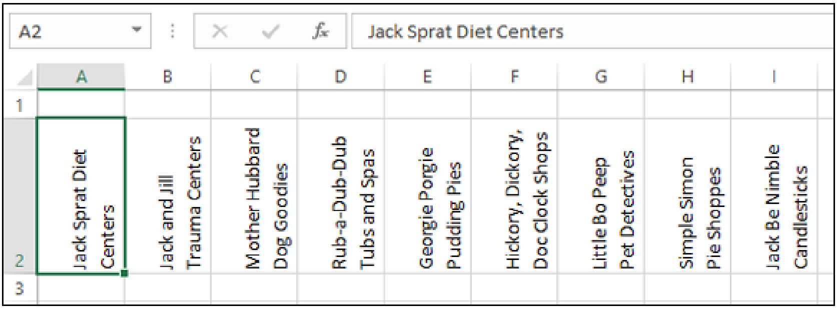
- **Angle Counterclockwise** rotates the text in the cell selection up 45 degrees from the baseline.
- **Angle Clockwise** rotates the text in the cell selection down 45 degrees from the baseline.
- **Vertical Text** aligns the text in the cell selection in a column where one letter appears over the other.
- **Rotate Text Up** rotates the text in the cell selection up 90 degrees from the baseline.
- **Rotate Text Down** rotates the text in the cell selection down 90 degrees from the baseline.
- **Format Cell Alignment** opens the Alignment tab on the Format Cells dialog box.

You can also alter the orientation of text in the cell selection on the

Alignment tab of the Format Cells dialog box (Ctrl + 1) using the following options in its Orientation area:

- Enter the value of the angle of rotation for the new orientation in the Degrees text box or click the spinner buttons to select this angle. Enter a positive value (such as 45) to have the characters angled above the normal 90-degree line of orientation and a negative value (such as –45) to have them angled above this line.
- Click the point on the sample Text box on the right side of the Orientation area that corresponds to the angle of rotation that you want for the characters in the selected cells.
- Click the sample Text box on the left side of the Orientation area to have the characters stacked one on top of the other (as shown in the orientation of the word “Text” in this sample box).

After changing the orientation of entries in a selection, Excel automatically adjusts the height of the rows in the cell selection to accommodate the rotation up or down of the cell entries. Figure 2-14 (sample workbook: MGE Q1 Sector Sales.xlsx) shows the top part of a worksheet after rotating the column headings for a new table up 90 degrees. Note how Excel increased the height of row 10 to accommodate this change.



Jack Sprat Diet Centers

	A	B	C	D	E	F	G	H	I
1									
2	Jack Sprat Diet Centers	Jack and Jill Trauma Centers	Mother Hubbard Dog Goodies	Rub-a-Dub-Dub Tubs and Spas	Georgie Porgie Pudding Pies	Hickory, Dickory, Doc Clock Shops	Little Bo Peep Pet Detectives	Simple Simon Pie Shoppes	Jack Be Nimble Candlesticks
3									

FIGURE 2-14: Worksheet after rotating a table’s column headings up 90 degrees. (Sample workbook: MGE Q1 Sector Sales.xlsx)

Fancy fonts and colors

You can assign any of the fonts that are installed on your computer to cells in a worksheet. Along with selecting a new font (also known as a *typeface*), you can choose a new font size (in points), assign a font style (such as bold, italic, underline, or strikethrough), as well as change the color of the font.

TIP On the Home tab, the Font group enables you to tell the font and font size of the cell entry in the active cell by looking at the font name displayed in the Font combo box and the point size displayed in the Font Size combo box. You can also tell which, if any, text attributes are assigned to the entry by looking at the Bold, Italic, and Underline buttons in this group. Excel indicates which of these attributes have been assigned to the cell by highlighting the **B**, *I*, or U button in the standard highlight color.

Selecting fonts and colors from the Ribbon

You can change the font, font size, font style, and font color using the command buttons in the Home tab's Font group. The only aspects you can’t change or assign are the type of the underlining (besides single or double) and special font styles including strikethrough, superscript, and subscript.

To change the font with the command buttons in the Home tab's Font group, select the cell, cell range, or nonadjacent selection to which you want to assign the new font, size, style, or color, and then do one of the following:

- To assign a new font to the selection, click the Font drop-down button and then select the font from the drop-down list.
- To assign a new point size to the selection, click the Font Size drop-down button and then select the size from the drop-down list. (You can also do this by clicking the Font text box, typing the point size, and pressing Enter.)
- To increase the font size, click the Increase Font Size button. Note that Excel increases the font size based on the entries in the Font Size drop-down list. For example, if the current font size is 11 points, clicking Increase Font Size changes the size to 12 points. Clicking the button a second time sets the font size to 14 points, and so on.
- To decrease the font size, click the Decrease Font Size button. Similarly, Excel decreases the font size based on the entries in the Font Size drop-down list. For example, if the current font size is 18 points, clicking Decrease Font Size changes the size to 16 points. Clicking the button a second time sets the font size to 14 points, and so on.

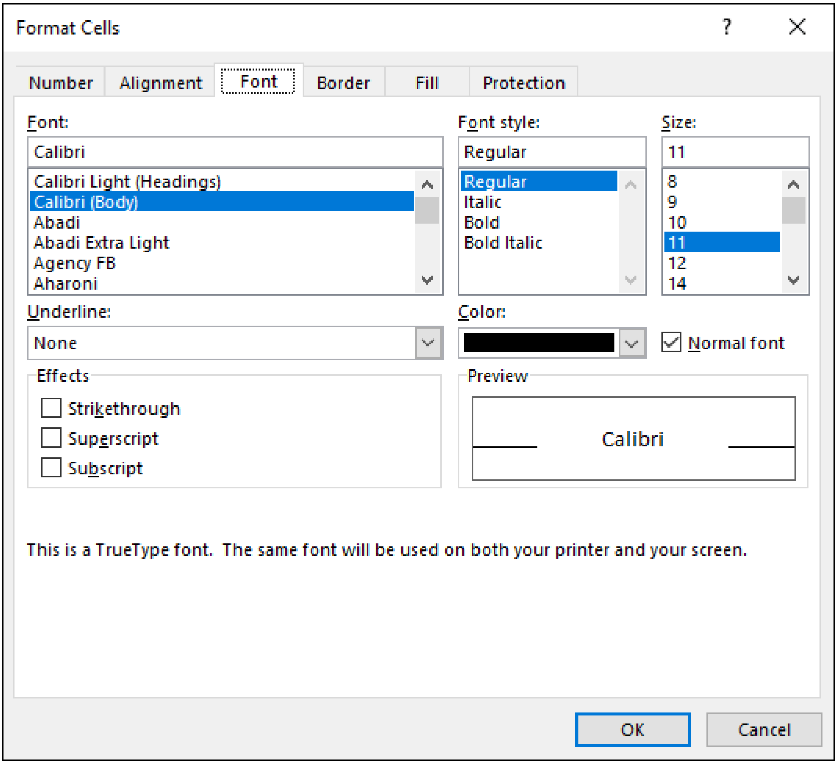
- To assign a new font style to a selection, click the appropriate tool in the Formatting toolbar: Click the Bold button (the one with **B**) to bold the selection, the Italic button (the one with *I*) to italicize the selection, and the Underline button (the one with the U) to underline the selection. To assign double underlining to the cell selection, click the drop-down button attached to the Underline button and then click Double Underline from its drop-down menu.
- To assign a new font color, click the Font Color pop-up button and then click the new color in the drop-down palette.

REMEMBER Live Preview enables you to see how the cell selection looks in a font or font size that you highlight on the Font or Font Size drop-down list — provided, of course, that the selection in the columns and rows is not obscured when these drop-down lists are displayed.

TIP Note that you can immediately remove any font change that you make by clicking the Undo button on the Quick Access toolbar (or by pressing Ctrl+Z). You can also remove boldface, italics, and underlining assigned to a cell selection by clicking the appropriate button (Bold, Italic, and Underline) on the Formatting toolbar. This action removes the darker shading that outlines the button's **B,** *I*, or U icon.

Selecting fonts and colors in the Format Cells dialog box

You can also select a new font, font size, font style, and font color for your selection on the Font tab of the Format Cells dialog box (Ctrl+1). Figure 2-15 shows the Font tab of the Format Cells dialog box that appears when an empty cell that uses the Normal style is active. In this figure, the current Font is Calibri (Body), the Font Style is Regular, the Font Size is 11 (points), the Underline is None, and the Color is Automatic.


Format Cells
?
Number
Alignment
Font
Border
Fill
Protection
Calibri Light (Headings)
Calibri (Body)
Abadi
Abadi Extra Light
Agency FB
Aharoni
Regular
Italic
Bold
Bold Italic
8
9
10
11
12
14
Effects
Preview
Calibri
OK
Cancel

Font: Calibri

Font style: Regular

Size: 11

Underline: None

Color:

☑ Normal font

☐ Strikethrough

☐ Superscript

☐ Subscript

This is a TrueType font. The same font will be used on both your printer and your screen.

FIGURE 2-15: You can assign new fonts, font sizes, attributes, and colors on the Font tab of the Format Cells dialog box.

To select a new font color from the Font Color drop-down palette in the Font group on the Ribbon's Home tab or from the Color drop-down palette on the Font tab of the Format Cells dialog box, click its drop-down button. Both drop-down palettes contain color swatches arranged in two groups: Theme colors to select one of the colors used in Excel's themes (see Book 5, Chapter 2) and Standard colors to select one of the primary Windows colors. To select a font color from either of these two groups, click its color swatch.

If none of the preset colors appeal, click the More Colors option at the bottom of the drop-down palette to open the Colors dialog box. This dialog box contains a Standard tab where you can select a new color by clicking its hexagram swatch in the color honeycomb or shade of gray hexagram below. The Custom tab enables you to select a custom color by changing the RGB (Red, Green, and Blue) or HSL (Hue, Saturation, and Luminosity) values. You can do this either by dragging through the color grid and tint slider at the top of the Custom tab or by entering new values in the Red, Green, and Blue (when the RGB Color Model is selected) or the Hue, Sat, and Lum (when the HSL Color Model is selected) text boxes below or by selecting them with their spinner buttons.

REMEMBER Excel adds a swatch for each custom color you select or define to a Recent Colors section that then appears on both the Font Color and Fill Color buttons' drop-down palettes, making it easy to apply these custom colors to the text and fills of other cells in the worksheet.

Basic borders, fills, and patterns

You can add borders as well as to assign new background fill colors, gradients, and shading patterns to cells in the worksheet. You can use the borders to outline tables of data — particularly important cells — or to underscore rows of key data. You can also apply various color gradients and shading patterns to cells to draw attention to significant aspects of the worksheet.

TIP When adding borders and shading, you can make your job a great deal easier by removing the gridlines used in the Worksheet area to indicate the borders of the cells in the worksheet. To remove these gridlines, deselect the View tab's Gridlines check box (or press Alt+WVG). After you've dispensed with a worksheet's gridlines, you can immediately tell whether you've added the kind of borders that you want and better judge the effect of the color and shading changes that you make.

Right on the borderline

When applying borders to a cell selection, you have a choice of methods:

- In the Home tab's Font group or on the mini-toolbar, use the options on the Borders drop-down menu.
- In the Format Cells dialog box, use the options on the Border tab.

You can compare the options offered by each in Figures 2-16 and 2-17.

Figure 2-16 shows the border options on the drop-down menu, and Figure 2-17 shows the options on the Border tab of the Format Cells dialog box.

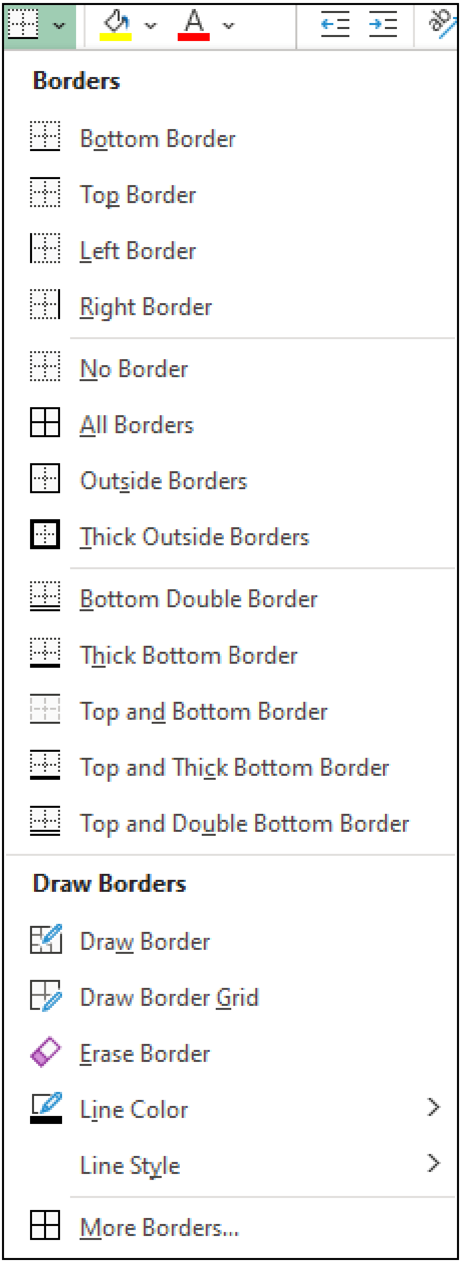
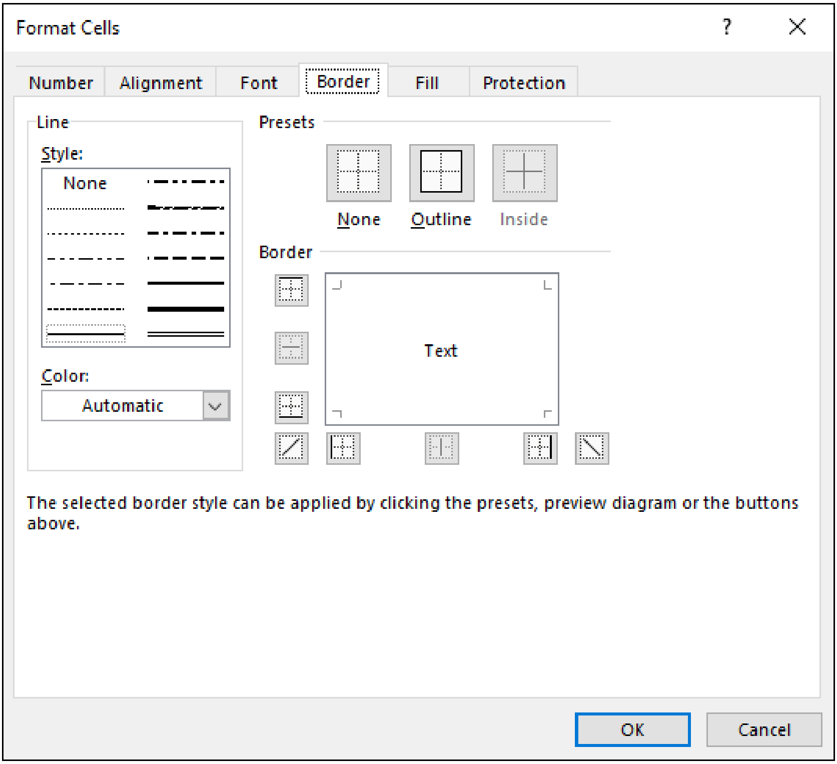

Borders
Bottom Border
Top Border
Left Border
Right Border
No Border
All Borders
Outside Borders
Thick Outside Borders
Bottom Double Border
Thick Bottom Border
Top and Bottom Border
Top and Thick Bottom Border
Top and Double Bottom Border
Draw Borders
Draw Border
Draw Border Grid
Erase Border
Line Color
Line Style
More Borders...

FIGURE 2-16: The border options available on the Home tab’s Borders button’s drop-down menu.


Format Cells
?
Number
Alignment
Font
Border
Fill
Protection
Line
Style:
None
Color:
Automatic
Presets
None
Outline
Inside
Border
Text
OK
Cancel

The selected border style can be applied by clicking the presets, preview diagram or the buttons above.

FIGURE 2-17: The border options available on the Border tab of the Format Cells dialog box.

To apply borders to the cell selection by using the options on the Borders button’s drop-down menu, choose the option on the menu with the type of border you want drawn. To remove a borderline that you select in error, click the No Border option.

While defining the borderlines to apply in the Border tab, you can select a new style for the borderlines by clicking the Line style in the Style sample area. To select a new color (besides boring old black) for the borderlines that you’re about to apply, click the swatch of the new color you want to use in the Color drop-down palette.

When using the Borders palettes to assign borderlines to a cell selection, your options are limited to just the Border buttons displayed on the palette. This means that you don’t have as much choice in terms of line style and type of borderlines. (In other words, you can’t be applying any dashed diagonal borderlines from this palette.) You also can't change the color of the borderlines from the Borders palette.

REMEMBER The Borders button's drop-down menu includes a couple of options that enable you to literally draw borders around a cell selection in your worksheet by dragging the mouse pointer through the cells. Click the Draw Border option to draw a border just outlining the cells you select or Draw Border Grid to draw borders around each and every cell you select with the mouse.

TIP To get rid of borderlines that you've added to a cell range, no matter which method you used to add them, select the range and then click the No Border option from the Borders button's drop-down menu.

Fun fills, great-looking gradients, and pretty patterns

In Excel, you can not only select new background colors (referred to as fill colors) for the cell selection, but you can also assign gradients (fills that gradually go from one color to another) and new dotted and crosshatched patterns to them.

When assigning a new fill color to the current cell selection, you can do this either by clicking a new color swatch on the Fill Color button's drop-down palette (located in the Font group on the Ribbon's Home tab) or by clicking the swatch in the Background Color area of the Fill tab in the Format Cells dialog box (Ctrl + 1) shown in Figure 2-18.

- To assign a gradient to the cell selection, click the Fill Effects button to open the Fill Effects dialog box. (See Figure 2-19.) Select the beginning gradient color by clicking its swatch on the Color 1 drop-down color palette and the ending gradient color by clicking its swatch on the Color 2 drop-down palette. Note that you can then further refine the gradient by selecting a new shading style option button that determines the direction of the gradient pattern before you click OK.
- To add a dotted or crosshatched shading pattern to the cell selection (instead of a gradient — they don't go together), click the

pattern square on the Pattern Style's drop-down palette. To change the color of the shading pattern (which is by default the black Automatic color), click a color swatch on the Pattern Color's drop-down palette.

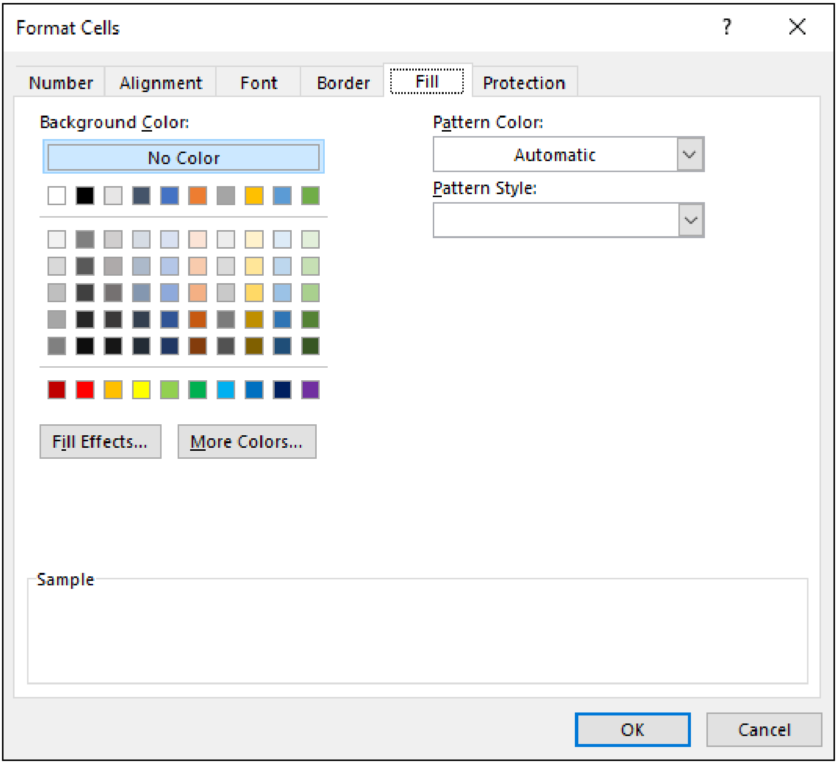

Format Cells
?
×
Number
Alignment
Font
Border
Fill
Protection
Background Color:
No Color
Pattern Color:
Automatic
Pattern Style:
Fill Effects...
More Colors...
Sample
OK
Cancel

FIGURE 2-18: Using the options on the Fill tab to select a new fill color, gradient, or shading pattern for your cell selection.

REMEMBER Check the Sample area at the bottom of the Fill tab of the Format Cells dialog box to check out the shading pattern and make sure that it's the one you want to use before you click OK to apply it to the cell selection. If you don't like the effect after you've applied it to the cell selection, click the Undo button on the Quick Access toolbar or press Ctrl+Z immediately to remove it.

TIP

To get rid of all fill colors, gradients, and shading patterns used in a cell selection, display the Home tab, click the Fill Color drop-down list, and then click the No Fill option.

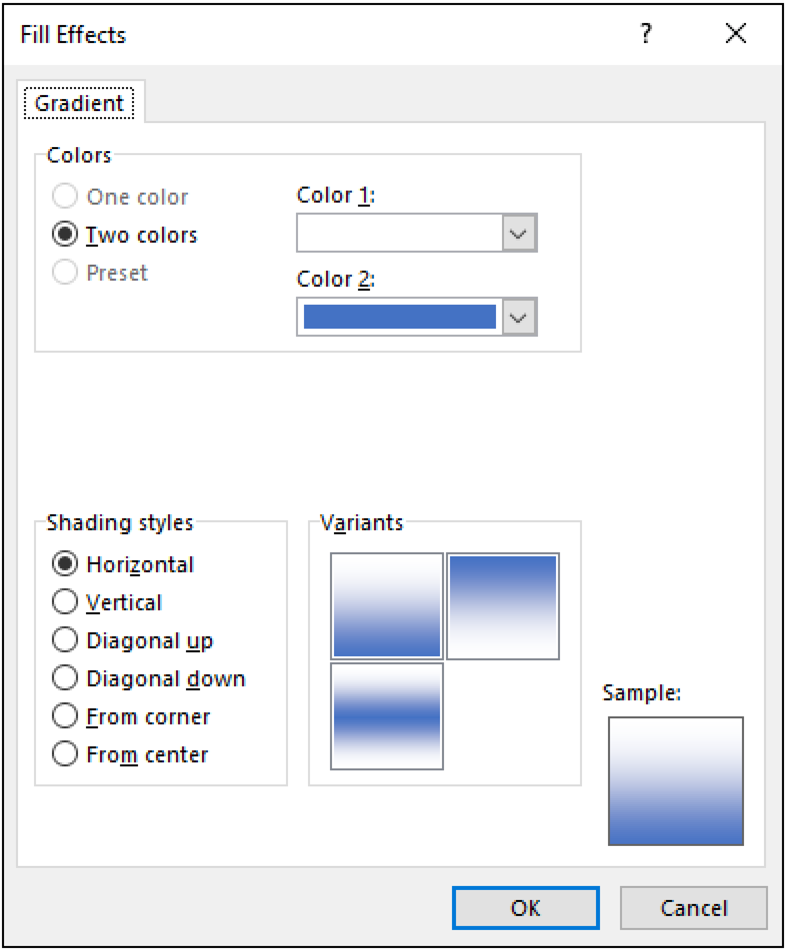

Fill Effects
?
Gradient
Colors
○ One color
● Two colors
○ Preset
Color 1:
Color 2:
Shading styles
● Horizontal
○ Vertical
○ Diagonal up
○ Diagonal down
○ From corner
○ From center
Variants
Sample:
OK
Cancel

FIGURE 2-19: Selecting a new gradient for your cell selection in the Fill Effects dialog box.

Hiring Out the Format Painter

The Home tab's Clipboard group includes the Format Painter button (with paintbrush icon), which copies formatting from the current cell and applies it to cells that you “paint” by dragging its special thick-white cross-plus-paintbrush mouse pointer through them. Format Painter provides a quick-and-easy way to take a bunch of different formats (such as a new font, font size, bold, and italics) that you applied individually to a cell in the worksheet and then apply them in one fell swoop to a new range of cells.

To use the Format Painter, follow these steps:

1. **Position the cell cursor in a cell that contains the formatting that you want copied to another range of cells in the worksheet.**

   The selected cell becomes the sample cell whose formatting is taken up by Format Painter and copied in the cells that you “paint” with its special mouse pointer.

2. **In the Home tab's Clipboard group, click the Format Painter button (with the paintbrush icon) or press Alt+HFP.**

   Excel adds a paintbrush icon to the standard thick white-cross mouse pointer, indicating that the Format Painter is ready to copy the formatting from the sample cell.

3. **Click the cell or drag the mouse pointer through the range of cells that you want formatted identically to the sample cell.**

When you release the mouse button, the cells in the range that you just selected with the Format Painter become formatted the same way as the sample cell.

TIP

Normally, using the Format Painter is a one-shot deal because as soon as you release the mouse button after selecting a range of cells with the Format Painter, it turns off, and the mouse pointer reverts to its normal function of just selecting cells in the worksheet (indicated by the return of the regular thick white-cross icon). If you ever want to keep the Format Painter turned on so that you can use it to format more than one range of cells in the worksheet, you need to double-click the Format Painter button. The Format Painter button remains selected (indicated by the shading) until you click its command button again. During this time, you can “paint” as many different cells or ranges in the worksheet as you desire.

Easier Formatting with Cell Styles

Cell styles combine a number of different formatting aspects that can include number format, text alignment, font and font size, borders, fills, and protection status. (See Book 4, Chapter 1.)

In Excel, cell styles really come alive in the form of the Cell Styles gallery that you open by clicking the Home tab's Cell Styles button (it's in the Styles group).

The Cell Styles gallery contains loads of ready-made styles you can immediately apply to the current cell selection. These predefined cell styles are arranged into various sections: Good, Bad, and Neutral; Data and Model; Titles and Headings; Themed Cell Styles; and Number Format. (See Figure 2-20.)

Hover the mouse or Touch pointer over the thumbnail styles to use Live Preview feature to view the effect of each style on your selected cell. Once you've determined which style looks best on your data, click the thumbnail of the desired style in the gallery.

Using the Number Format cell styles

The Number Format section near the bottom of the Cell Styles gallery (see Figure 2-20) contains the following five predefined styles that you can use to format the values entered into the cell selection as follows:

- **Comma** sets the number format to the Comma Style (same as clicking the Home tab's Comma Style button in the Number group).

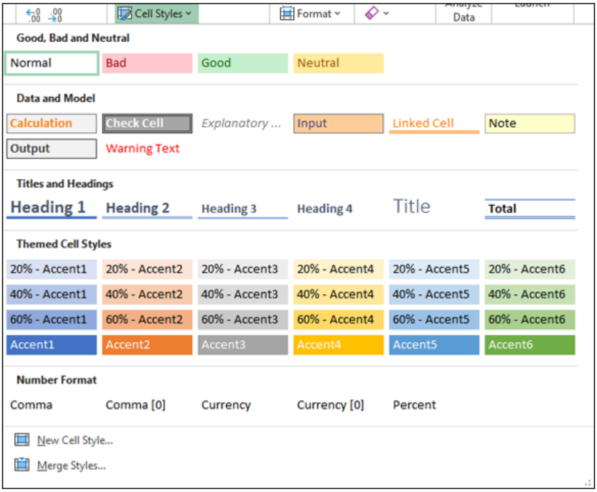

Cell Styles
Format
Data
Good, Bad and Neutral
Normal
Bad
Good
Neutral
Data and Model
Calculation
Check Cell
Explanatory ...
Input
Linked Cell
Note
Output
Warning Text
Titles and Headings
Heading 1
Heading 2
Heading 3
Heading 4
Title
Total
Themed Cell Styles
20% - Accent1
20% - Accent2
20% - Accent3
20% - Accent4
20% - Accent5
20% - Accent6
40% - Accent1
40% - Accent2
40% - Accent3
40% - Accent4
40% - Accent5
40% - Accent6
60% - Accent1
60% - Accent2
60% - Accent3
60% - Accent4
60% - Accent5
60% - Accent6
Accent1
Accent2
Accent3
Accent4
Accent5
Accent6
Number Format
Comma
Comma [0]
Currency
Currency [0]
Percent
New Cell Style...
Merge Styles...

FIGURE 2-20: You can apply multiple styles to a cell selection using the Cell Styles gallery.

- **Comma (0)** sets the number format to the Comma Style format without any decimal places.
- **Currency** sets the number format to the Currency style format (same as clicking the Home tab's Accounting Number Format button in the Number group).
- **Currency (0)** sets the number format to the Currency style format without any decimal places (making your financial figures all dollars and no cents).
- **Percent** sets the number format to Percent style (same as clicking the Home tab's Percent Style button in the Number group).

REMEMBER You can combine the number formatting assigned from one of the Number Format cell styles with the other cell formatting assigned by the cell styles in the other three cell style groups: Good, Bad, and Neutral (except for Normal, which applies the General number format); Data and Model; and Themed Cell Styles. To do this, first assign the number formatting by clicking its style in the Number Format section of the Cell Styles gallery, and then assign the other formatting by clicking its style in one of the other three sections of the Cell Styles gallery.

TIP Click Normal, the first style in the Good, Bad, and Neutral section, in the Cell Styles gallery to return the formatting in the cell selection to its original state: General number format, left or right (depending on the contents), horizontal and bottom vertical alignment, Calibri (body), 11-point font size (unless you've changed the default font and size), no borders, no fill, and locked protection status.

Defining a custom cell style by example

You don't have to live with just the predefined styles that Excel gives you on the Cell Styles gallery because you can create custom cell styles of your own.

By far the easiest way to create a new custom cell style is by example. When you create a cell style by example, you choose a cell that already displays all the formatting attributes (applied separately using the techniques discussed previously in this chapter) that you want included in the new cell style. Then, you follow these steps to create the new style by using the formatting in the sample cell:

1. **Position the cell pointer in the cell with the formatting that you want in the new style.**
2. **In the Home tab's Styles group, choose Cell Styles ⇒ New Cell Style.**

   Excel opens the Style dialog box with a generic style name (Style 1, Style 2, and so on), and the formatting attributes applied to the cell are listed in the Style Includes (By Example) section of the dialog box.
3. **Type the name for the new style in the Style Name text box.**
4. **(Optional) Deselect the check box for any attribute (Number, Alignment, Font, Border, Fill, or Protection) that you don't want included in the new style.**
5. **Click OK to create your new style.**

WARNING When defining a style by example, select only one cell that you know contains all the formatting characteristics that you want in the new style. This way, you avoid the potential problem of selecting cells that don’t share the same formatting. If you select cells that use different formatting when defining a style by example, the new style will contain only the formatting that all cells share in common.

TIP After you create your first custom style, Excel creates a Custom section at the top of the Cell Styles gallery. For each custom style you create, Excel adds a thumbnail for the new style to the Custom section. To apply this new custom cell style to other cell selections in the worksheet, click its thumbnail in the Custom section of the gallery.

Creating a new cell style from scratch

You can also create a custom cell style from scratch by defining each of its formatting characteristics in the Style dialog box as follows:

1. **Position the cell pointer in the cell you want to format with your custom style.**

   It's best if this cell has no formatting applied. To ensure this, in the Home tab's Editing group, choose Clear ⇒ Clear Formats (or press Alt + HEF).

2. **In the Home tab's Styles group, choose Cell Styles ⇒ New Cell Style.**
3. **Type a name for the new style that you’re defining in the Style Name text box (replacing Style 1, Style 2, generic style name).**
4. **Click the Format button in the Style dialog box.**

   Excel opens the standard Format Cells dialog box, where you can use the options on its six tabs (Number, Alignment, Font, Border, Fill, and

Protection) to select all the formatting attributes that you do want used when you apply the new style to a cell selection.

5. **Click OK to return to the Style dialog box.**

   The Style Includes (By Example) section now lists all the attributes that you assigned in the Format Cells dialog box.

6. **Click OK to create your custom style.**

Excel applies the formatting in your newly defined custom style to the current cell and adds the new style to the Custom section of the Cell Styles gallery. To apply this new custom cell style to other cell selections in the worksheet, click its thumbnail in the Custom section of the gallery.

REMEMBER To remove a custom style from the Cell Styles gallery that you've defined by example or from scratch, you have to right-click its thumbnail in the gallery and then click Delete on its shortcut menu.

Merging styles into other workbooks

All custom cell styles that you create are saved, along with the data and formatting in the workbook, when you save the file. The only styles, however, that are available when you begin a new workbook are those predefined styles provided by Excel.

If you've created custom styles in another workbook that you want to use in a new workbook or in an existing one that you've opened for editing, you have to merge them into that workbook as follows:

1. **Open the workbook file containing the custom styles that you want to copy and use.**

   You must have the workbook containing the custom styles to merge open, along with the workbook into which these custom styles will be copied.

2. **Switch to the workbook file into which you want to merge the**

custom styles.

3. **In the Home tab's Styles group, choose Cell Styles ⇒ Merge Styles.**

   Excel opens the Merge Styles dialog box with a list box that displays the filenames of all the workbooks that are currently open in the program.

4. **Click the name of the workbook that contains the custom styles you want merged into the active workbook and then click OK.**

   If the workbook file that you selected contains custom styles with the same names as the custom styles defined in the active workbook, Excel displays an alert box that asks whether you want to merge the styles that have the same names. Click Yes to replace all styles in the active workbook with those that have the same name in the workbook file that you're copying from. Click No if you don't want the styles in the active workbook to be overwritten, in which case Excel merges the styles with unique names from the other workbook.

After merging styles from another open workbook, you can apply the merged custom styles, which now appear in the Custom section at the top of the Cell Styles gallery.

Analyzing Data with Conditional Formatting

Excel's Conditional Formatting feature enables you to format a range of values so that unusual or unwanted values, or values outside certain limits, are automatically formatted in such a way as to call attention to them.

In the Home tab's Styles group, clicking the Conditional Formatting button displays a drop-down menu with the following options:

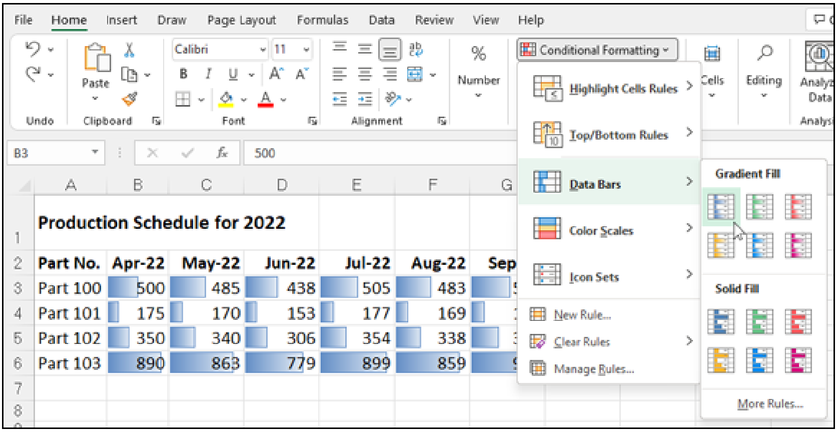
- **Highlight Cells Rules** opens a continuation menu with options for defining formatting rules that highlight the cells in the cell selection that contain certain values, text, or dates, or that have values greater or less than a particular value, or that fall within a specified range of values.
- **Top/Bottom Rules** opens a continuation menu with options for defining formatting rules that highlight the top and bottom values, percentages, and above and below average values in the cell selection.
- **Data Bars** opens a palette with different color data bars that you can apply to the cell selection to indicate their values relative to each other using bars that appear within each cell.
- **Color Scales** opens a palette with different three- and two-colored scales that you can apply to the cell selection to indicate their values relative to each other using colors.
- **Icon Sets** opens a palette with different sets of icons that you can apply to the cell selection to indicate their values relative to each other using icons.
- **New Rule** opens the New Formatting Rule dialog box, where you define a custom conditional formatting rule to apply to the cell selection.
- **Clear Rules** opens a continuation menu, where you can remove conditional formatting rules for the cell selection by clicking the Clear Rules from Selected Cells option; for the entire worksheet by clicking the Clear Rules from Entire Sheet option; for just the current table by clicking the Clear Rules from This Table option; or for just the current PivotTable by clicking the Clear Rules from This PivotTable option.
- **Manage Rules** opens the Conditional Formatting Rules Manager dialog box, where you edit and delete particular rules as well as adjust their rule precedence by moving them up or down in the Rules list box.

Graphical conditional formatting

If you're a visual person, then you may find the most useful conditional formatting you can apply to a cell range is with the sets of graphical markers that enable you to see at a glance the values in your range relative to each other. Excel offers three such graphical markers on the Conditional Formatting button’s drop-down menu:

- **Data Bars** represents the relative values in the cell selection by the length of the color bar in each cell. Data bars are a great way to quickly pinpoint the lower and higher values within a large range of data.
- **Color Scales** classify the relative values in a cell selection with a color gradation using a one-, two-, or three-color scale. Color scales are great for identifying the distribution of values across a large range of data.
- **Icon Sets** classify the values in the cell selection into three to five categories, and each icon within the set represents a range of values that go from high to low. Icon sets are useful for quickly identifying the different ranges of values in your data.

Figure 2-21 (sample workbook: Production Schedule 2022.xlsx) shows how the initial Data Bars gradient fill appears when applied to the range B2:J6 (partially obscured by the menu in Figure 2-21). As you can see, the larger the value in a cell, the longer the data bar.


File
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Help
Calibri
11
Paste
Undo
Clipboard
Font
Alignment
Number
Conditional Formatting
Highlight Cells Rules
Top/Bottom Rules
Data Bars
Color Scales
Icon Sets
New Rule...
Clear Rules
Manage Rules...
Gradient Fill
Solid Fill
More Rules...
Cells
Editing
Analyze Data
Analysis

B3

500

Production Schedule for 2022

Part No.	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep
Part 100	500	485	438	505	483	
Part 101	175	170	153	177	169	
Part 102	350	340	306	354	338	
Part 103	890	863	779	899	859	

FIGURE 2-21: The initial Data Bars gradient fill applied to some worksheet data. (Sample workbook: Production Schedule 2022.xlsx)

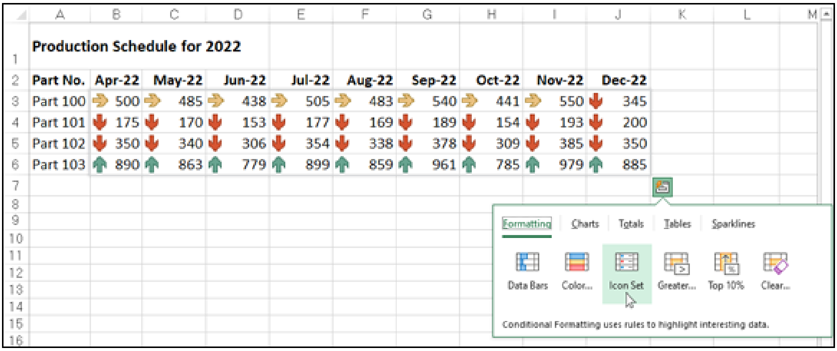
TIP

If you want to hide the values in a cell range and only display a type of graphical conditional formatting, apply the desired graphical conditional formatting to the range of numeric entries and then hide the underlying values by formatting the same cell range with the custom numeric format that masks the numeric entries (;;;), as described in "Designing your own number formats," earlier in this chapter.

Conditional formatting with the Quick Analysis tool

Excel's Quick Analysis tool enables you to apply various types of conditional formatting to selected cell ranges. Figure 2-22 (sample workbook: Production Schedule 2022.xlsx) illustrates how this works. For this figure, I selected the cell range B3:J6, clicked the Quick Analysis tool that appears in the lower-right below the last selected cell, and then hovered the mouse pointer over the Icon Set option.

The Formatting tab is automatically selected with its conditional formatting option buttons (Data Bars, Color Scale, Icon Set, Greater Than, Top 10%, and Clear Format) displayed. You can then use Live Preview to sample how the selected data would appear in different conditional formats. When you see one you like, you can then apply it by clicking the particular conditional formatting option button.



Production Schedule for 2022

Part No.	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22
Part 100	➡ 500	➡ 485	➡ 438	➡ 505	➡ 483	➡ 540	➡ 441	➡ 550	⬇ 345
Part 101	⬇ 175	⬇ 170	⬇ 153	⬇ 177	⬇ 169	⬇ 189	⬇ 154	⬇ 193	⬇ 200
Part 102	⬇ 350	⬇ 340	⬇ 306	⬇ 354	⬇ 338	⬇ 378	⬇ 309	⬇ 385	⬇ 350
Part 103	⬆ 890	⬆ 863	⬆ 779	⬆ 899	⬆ 859	⬆ 961	⬆ 785	⬆ 979	⬆ 885

Conditional Formatting uses rules to highlight interesting data.

FIGURE 2-22: You can use the Quick Analysis tool's Formatting option to apply conditional formatting to a cell selection. (Sample workbook: Production Schedule 2022.xlsx)

Identifying particular values or text entries in a cell range

The options attached to the Highlight Cell Rules and Top/Bottom Rules items on the Conditional Formatting button's drop-down menu enable you to specify a particular type of formatting when certain conditions are met.

The rules that you set up for meeting these formatting conditions can vary widely. You can set up a rule whereby a particular type of formatting is applied when a cell in the range contains a certain text entry (such as Fixed or Variable). You set up a rule whereby a particular type of formatting is applied when a cell in the range is exactly a particular value or exceeds or falls below a particular value. So too, you can set up a rule whereby a particular type of formatting is applied when the value is one of the top ten in the range, is below the average value in the range, or falls into the lower ten percent.

For example, to set up the rule where Excel formats any cell within a range with a light red fill color and dark red font color whenever it contains the word *Fixed,* you follow these steps:

1. **Select the range of cells in the worksheet to which this conditional formatting rule is to be applied.**
2. **In the Home tab, click the Conditional Formatting button and then choose Highlight Cell Rules ⇒ Text That Contains from the drop-down menu.**

   Excel opens the Text That Contains dialog box with a text box on the left where you enter or select in the worksheet the text that tells Excel when to apply the conditional formatting and a drop-down list box on the right where you select or define the conditional formatting the program is to apply.
3. **Type** Fixed **in the Format Cells That Contain the Text box.**

   In this case, you don't have to change the formatting in the drop-down list box, as Light Red Fill with Dark Red Text is the default formatting.
4. **Click OK to apply the conditional formatting rule to the selected cell range.**

Say you wanted to apply three different types of conditional formatting to the cells in a single range of the worksheet: one type of formatting whenever a cell in the range contains a target value, another when it exceeds this target value, and a third when it falls below the target value.

Here are the steps for setting up the rules to apply a yellow fill with a dark yellow font to cells in a range when they contain 100,000, a green fill with dark green text when they're greater than 100,000, and a light red fill with dark red text when they're less than 100,000:

1. **Select the range of cells in the worksheet to which the three conditional formatting rules are to be applied.**

   Start by defining the rule that applies yellow fill with dark yellow font to all values in the range that are equal to 100,000.

2. **In the Home tab, click the Conditional Formatting and then choose Highlight Cell Rules ⇒ Equal To from the drop-down menu.**

   Excel opens the Equal To dialog box, where you define the formatting rule when a cell contains 100,000.

3. **Type** 100,000 **in the Format Cells That Are EQUAL TO text box and then select Yellow Fill with Dark Yellow Text from the drop-down list box to the right before you click OK.**

   Next, you define the rule that applies green fill with dark green font to all values that are greater than 100,000.

4. **In the Home tab, click the Conditional Formatting button and then choose Highlight Cell Rules ⇒ Greater Than from the drop-down menu.**

   Excel opens the Greater Than dialog box, where you define the formatting rule when a cell contains a value higher than 100,000.

5. **Type** 100,000 **in the Format Cells That Are GREATER THAN text box and then click Green Fill with Dark Green Text in the drop-down list box to the right before you click OK.**

   Finally, you define the rule that applies red fill with dark red font to all values that are less than 100,000.

6. **In the Home tab, click the Conditional Formatting button and then choose Highlight Cell Rules ⇒ Less Than from the drop-down menu.**

   Excel opens the Less Than dialog box, where you define the formatting rule when a cell contains a value below 100,000.

7. **Type** 100,000 **in the Format Cells That Are LESS THAN text box and then leave the default Light Red Fill with Dark Red Text selected in the drop-down list box to the right when you click OK.**

As you define the three rules, Excel applies them to the range selected in the worksheet. If the cell range is blank at the time you set up these three rules, all the blank cells in the range are given a red fill. As you enter values into the cells, their text takes on the color assigned to their values: dark red font for values below 100,000, dark yellow for all values of 100,000, and dark green for all values above 100,000. In addition, when the values are equal to 100,000, Excel fills the cell with a light yellow background color and when values are above 100,000, a light green background color.

Finally, here are the steps you'd follow to create a rule that formats all values in a cell range that are below the average value in the range with a custom conditional format that applies bold italic to the font and a bright yellow fill color:

1. **Select the range of cells in the worksheet to which this conditional formatting rule is to be applied.**
2. **In the Home tab, click the Conditional Formatting button and then choose Top/Bottom Rules ⇒ Below Average from the drop-down menu.**

   Excel opens the Below Average dialog box that contains a single drop-down list box where you define the formatting to be used when a value is below the calculated average for the cell range.

3. **Select Custom Format at the bottom of the Format Cells That Are BELOW AVERAGE drop-down list**

box.

Excel opens the Format Cells dialog box where you define all the attributes to be part of the custom conditional formatting.

4. **Click the Font tab in the Format Cells dialog box and then click Bold Italic in the Font Style list box.**
5. **Click the Fill tab in the Format Cells dialog box and then click the bright yellow swatch in the Background Color section before you click OK.**

   Excel closes the Format Cells dialog box, returning you to the Below Average dialog box, which now displays Custom Format in the Format Cells That Are BELOW AVERAGE drop-down list box.
6. **Click OK to close the Below Average dialog box.**

Excel then applies the custom formatting of bold italic text with bright yellow fill color to all values in the cell selection that are below the calculated average (displayed after the Average heading on the status bar at the bottom of the Excel program window).

Highlighting duplicate values in a cell range

The Duplicate Values option on the Highlight Cell Rules continuation menu enables you to highlight duplicate values within a selected cell range.

To highlight duplicate values in a cell range, follow these steps:

1. **Select the range of cells in the worksheet where you want duplicates formatted in a special way.**
2. **In the Home tab, click the Conditional Formatting button and then choose Highlight Cell Rules ⇒ Duplicate Values from the drop-down menu.**

   Excel opens the Duplicate Values Columns dialog box containing two drop-down lists: the first where you indicate whether Excel is to format identical values (Duplicate, the default) in the range or the standalone values (Unique) in the range, and the second where you indicate the type of formatting applied to either the duplicates or one-of-a-kind values.

3. **Click the type of preset formatting (Red Fill with Dark Red Text, Yellow Fill with Dark Yellow Text, Green Fill with Dark Green Text, and so forth) or click the Custom Format option and select the custom formatting in the Format Cells dialog box.**

   If you define a custom format rather than select one of the preset formats, use the options on the Number, Font, Border, and Fill tabs of the Format Cells dialog box to designate all the formatting to be applied, and then click OK to close the Format Cells dialog box and return to the Compare Columns dialog box (where Custom Format appears in the third drop-down list box).

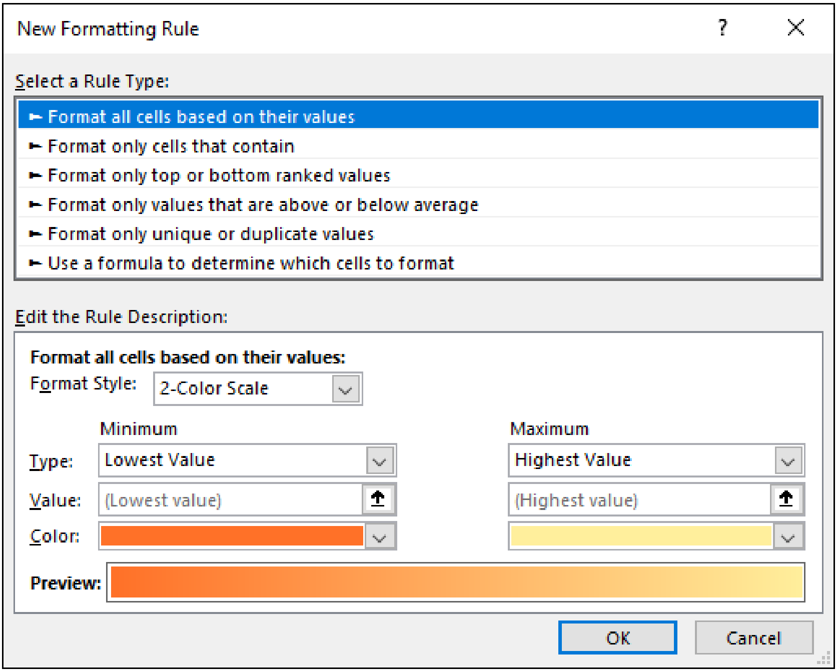
4. **Click OK to close the Duplicate Values dialog box.**

Excel then formats all the cells in the selected cell range whose values are exact duplicates with the conditional formatting you selected.

Creating your own conditional formatting rules

Although Excel gives you a ton of ready-made conditional formatting rules to apply, you may still find that you need to create your own rules for conditional formatting. To do this, you choose the New Rule option near the bottom of the Conditional Formatting button's drop-down menu or you click the New Rule button in the Conditional Formatting Rules Manager dialog box. (See the "Managing conditional formatting rules" section that immediately follows.)

Figure 2-23 shows the New Formatting Rule dialog box as it first appears after you click the New Rule option or button. To create a new conditional formatting rule, you first click the type of rule to create in the Select a Rule Type list box and then specify the criteria and define the formatting using the various options that appear in the Edit the Rule Description section below — note that these options vary greatly depending on the type of rule you select from the Select a Rule Type list box above.


New Formatting Rule
?
Select a Rule Type:
Format all cells based on their values
Format only cells that contain
Format only top or bottom ranked values
Format only values that are above or below average
Format only unique or duplicate values
Use a formula to determine which cells to format
Edit the Rule Description:
Minimum
Maximum
Color:
Preview:
OK
Cancel

Format all cells based on their values:

Format Style: 2-Color Scale

Type: Lowest Value — Highest Value

Value: (Lowest value) — (Highest value)

FIGURE 2-23: Define a new conditional formatting rule using the options in the New Formatting Rule dialog box.

TIP

Select the Use a Formula to Determine Which Cells to Format rule type when you want to build a formula as the rule that determines when a particular type of conditional formatting is applied. Note that this formula can refer to cells outside the current cell selection to which the conditional formatting is applied, but it must be a logical formula, meaning that it uses comparison operators (see Book 3, Chapter 1) and/or Logical functions (see Book 3, Chapter 2) that when calculated return either a logical TRUE or FALSE value.

Managing conditional formatting rules

The Conditional Formatting Rules Manager dialog box, which you open by choosing the Manage Rules option at the very bottom of the Conditional Formatting button's drop-down menu, enables you to do all the following:

- Create new rules by clicking the New Rule button to open the New Formatting Rule dialog box. (See the “Creating your own conditional formatting rules” section immediately preceding.)
- Edit existing rules by selecting the rule in the Rule list box and clicking the Edit Rule button in the Editing Formatting Rule dialog box (which looks just like the New Formatting Rule dialog box except it contains the rule type, criteria, and formatting for the particular rule you selected).
- Delete rules by clicking the rule in the Rule list box and then clicking the Delete Rule button — click the Apply button to remove formatting from the worksheet that was applied to the rule you just deleted.
- Change the order of precedence in which multiple conditional formatting rules assigned to the same cell selection or table are applied by promoting or demoting individual rules in the Rule list box by clicking the rules and then clicking either the Move Up button (with the thick arrow pointing upward) or Move Down button (with the thick arrow pointing downward) until the rules appear in the desired order of precedence.

TIP By default, the Conditional Formatting Rules Manager dialog box shows all the rules assigned only to the current cell selection or table. To see all the conditional formatting rules in a particular worksheet or table, use the Show Formatting Rules For drop-down list to either select This Worksheet (to see the rules in the active sheet) or select the worksheet name.

REMEMBER A rule that appears higher in the Rule list box of the Conditional Formatting Rules Manager dialog box has a higher precedence and is therefore applied before one lower in the list. When more than one rule is true, what happens depends on whether the formatting applied by those rules conflict. When they don’t conflict (as when one rule formats the cells in bold italic and the other formats the cells with a light red fill), both formats are applied. However, when the formats conflict (as when one rule formats the cells with black fill and bright yellow text and the other formats the cells with yellow fill and black text), the rule with the higher precedence wins, and only its conditional formatting is applied.

Chapter 3

Editing and Proofing Worksheets

IN THIS CHAPTER

- **Opening workbooks for editing**
- **Using basic cell-editing techniques**
- **Zooming in and out on the worksheet**
- **Freezing columns and rows on the screen**
- **Copying and moving data entries**
- **Finding and replacing data entries**
- **Proofing the worksheet**
- **Using data validation to circle invalid data entries in the worksheet**

Creating a worksheet is seldom a one-time experience. In fact, some of the worksheets that you create with Excel require routine changes on a regular basis, whereas others require more radical changes only once in a while. Regardless of the extent of the changes and their frequency, you can be sure that sooner or later, most of the worksheets you create in Excel will require editing.

In this chapter, you find out how to make basic editing changes in a worksheet by modifying the contents of a cell as well as how to do more complex editing in your worksheets. These techniques include how to use the Undo and Redo features, zoom in and out on data, move and copy data, delete data entries and insert new ones, search and replace data entries, and proof the contents of the final worksheet.

However, before you can use any of these fine editing techniques, you have to open the workbook whose contents require editing. So, with that in mind, this chapter starts out by giving you the lowdown on finding and opening workbooks in Excel.

Opening a Workbook

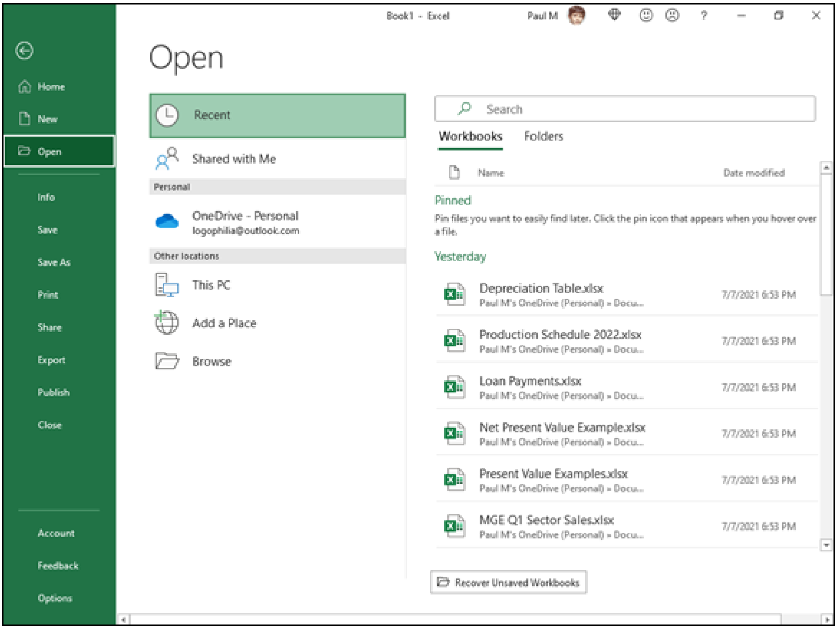
One way to open a workbook for editing in Excel is to navigate to the workbook's folder using File Explorer and then double-click the workbook file icon. If Excel isn't running, Windows launches Excel and then opens the file.

REMEMBER Excel automatically saves workbook files in your Documents folder on your OneDrive unless you select another folder or you save your workbooks locally on a hard drive or network drive connected to your device. You can type the name of the workbook file in the taskbar's Type Here to Search text box, or you can use Cortana to locate the file by saying to her “Find …” followed by the name of the workbook file.

Using the Open screen in the Backstage view

If Excel is already running and you want to open a workbook file for editing from within Excel, you can choose File ⇒ Open or press Alt + FO or Ctrl + O to launch the Open screen in the Backstage view and locate and open the file.

When Excel displays the Open screen (similar to the one shown in Figure 3-1), the program selects the Recent option on the left, while listing recently opened files under the Workbooks tab on the right. If the workbook file you want to edit is listed there, you can open the file by clicking its name in the list. If the Excel file you want to edit isn’t in the list of workbooks but in one of the folders in which you routinely save your workbooks, click the Folders tab to the immediate right of the Workbooks tab to switch to a list of folders from which you’ve recently retrieved workbooks. When you locate the folder with the file you need, double-click it and then double-click its file icon to open the workbook in Excel.


Book1 - Excel
Paul M
Home
New
Open
Info
Save
Save As
Print
Share
Export
Publish
Close
Account
Feedback
Options
Open
Recent
Shared with Me
Personal
OneDrive - Personal
logophilia@outlook.com
Other locations
This PC
Add a Place
Browse
Search
Workbooks
Folders
Pinned
Yesterday
Recover Unsaved Workbooks

Pin files you want to easily find later. Click the pin icon that appears when you hover over a file.

Name	Date modified
Depreciation Table.xlsx Paul M's OneDrive (Personal) » Docu...	7/7/2021 6:53 PM
Production Schedule 2022.xlsx Paul M's OneDrive (Personal) » Docu...	7/7/2021 6:53 PM
Loan Payments.xlsx Paul M's OneDrive (Personal) » Docu...	7/7/2021 6:53 PM
Net Present Value Example.xlsx Paul M's OneDrive (Personal) » Docu...	7/7/2021 6:53 PM
Present Value Examples.xlsx Paul M's OneDrive (Personal) » Docu...	7/7/2021 6:53 PM
MGE Q1 Sector Sales.xlsx Paul M's OneDrive (Personal) » Docu...	7/7/2021 6:53 PM

FIGURE 3-1: Use the Open screen to find and open a workbook for editing.

If the workbook file isn't among those in the Recent list, you need to select its location from another location:

- **Shared with Me:** Displays a list of workbooks that your coworkers or clients have shared with you. (See Book 4, Chapter 3 for more on sharing Excel workbooks.)
- **OneDrive:** Displays your OneDrive folders.
- **This PC:** Displays your PC's folders, which includes removable storage devices connected to your computer or tablet PC.
- **Add a Place:** Enables you to add a folder on your OneDrive or SharePoint website to the list of places in the Open screen for easy access.
- **Browse:** Displays the Open dialog box where you can search for misplaced workbook files or open a folder not listed in the Open screen.

REMEMBER If your company maintains a SharePoint Team website where you save Excel workbook files and you’ve added it as a place (with the Add a Place link), its name will also appear under the Places heading on the Excel Open screen.

TIP Click the Recover Unsaved Workbooks button at the bottom of the Recent screen if you ever need to open a workbook that you inadvertently didn’t save on one of your computer’s local drives before you closed the file. Excel displays the Open dialog box showing the contents of the UnsavedFiles folder, containing a list of any workbook files that the program automatically saved there before closing the Excel program window. Unfortunately, the filenames in this list, as in Book1((Unsaved 30683148768452)), are pretty nondescript, and there are no worksheet previews available (because the files never got saved, so no previews got created). This means that you need to rely on the date and time listed in the Date Modified column of the Open dialog box to help you identify the file you want to open for editing. When you click the filename of the unsaved file to open followed by the Open button, Excel opens it in the program window in Read Only mode with an alert appearing beneath the Ribbon indicating that this is a recovered file. You can then click the Save As button at the end of the alert text to open the Save As dialog box where you can properly name and save the file, thus enabling you to edit it contents.

When you select the location containing your workbook file, the Open screen displays links to that location's folders. (See Figure 3-2.) You can click one of these links to select its folder and display its files. If you can't find the workbook you want to open, you can select the Browse button to peruse the folders and files on the selected location in the ensuing Open dialog box.

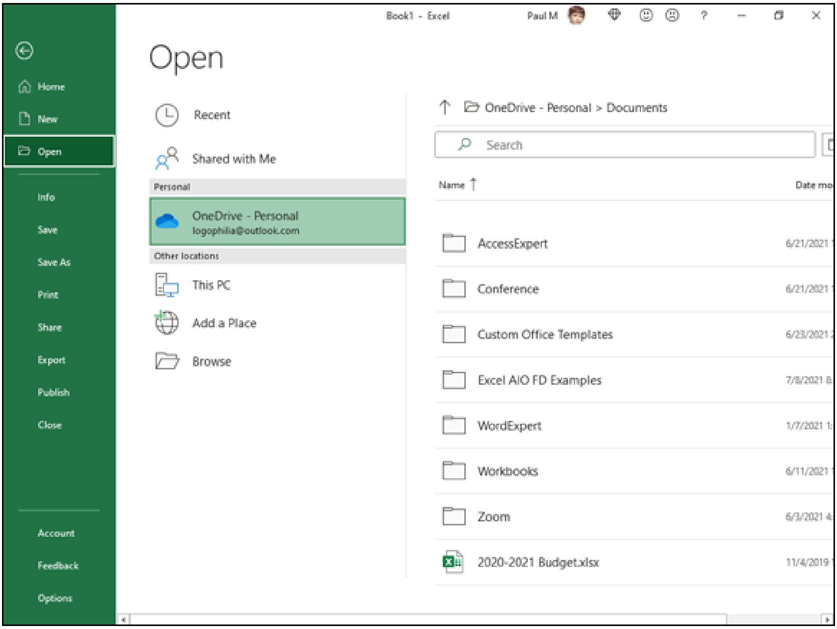

Book1 - Excel
Paul M
Home
New
Open
Info
Save
Save As
Print
Share
Export
Publish
Close
Account
Feedback
Options
Open
Recent
Shared with Me
Personal
OneDrive - Personal
logophilia@outlook.com
Other locations
This PC
Add a Place
Browse
OneDrive - Personal > Documents
Search
Name
AccessExpert
Conference
Custom Office Templates
Excel AIO FD Examples
WordExpert
Workbooks
Zoom
2020-2021 Budget.xlsx

FIGURE 3-2: Select a location to see its folders.

When the Open dialog box is displayed, the contents of the selected location or recently visited folder are listed in its main pane. (See Figure 3-3.) If you see the name of the workbook you want to edit in this list, double-click the file, or click the file and then click Open to load the workbook into Excel.

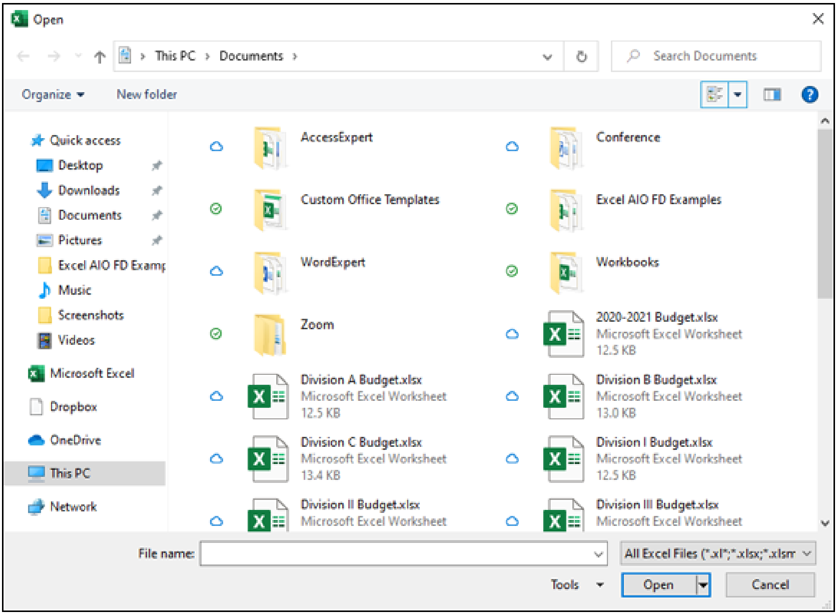

Open
This PC › Documents ›
Search Documents
Organize ▾
New folder
Quick access
Desktop
Downloads
Documents
Pictures
Excel AIO FD Examp
Music
Screenshots
Videos
Microsoft Excel
Dropbox
OneDrive
This PC
Network
AccessExpert
Conference
Custom Office Templates
Excel AIO FD Examples
WordExpert
Workbooks
Zoom
2020-2021 Budget.xlsx
Microsoft Excel Worksheet
12.5 KB
Division A Budget.xlsx
Microsoft Excel Worksheet
12.5 KB
Division B Budget.xlsx
Microsoft Excel Worksheet
13.0 KB
Division C Budget.xlsx
Microsoft Excel Worksheet
13.4 KB
Division I Budget.xlsx
Microsoft Excel Worksheet
12.5 KB
Division II Budget.xlsx
Microsoft Excel Worksheet
Division III Budget.xlsx
Microsoft Excel Worksheet
File name:
All Excel Files (*.xl*;*.xlsx;*.xlsm
Tools ▾
Open
Cancel

FIGURE 3-3: You can use the Open dialog box to select the workbook file you want to open.

REMEMBER If you open a new folder and it appears empty of all files (and you know that it's not an empty folder), this just means the folder doesn't contain any of the types of files that Excel can open directly, such as workbooks, template files, and macro sheets. To display all the files, whether Excel can open them directly (meaning without some sort of conversion), click the drop-down button that says All Excel Files and then select the All Files option at the top of its drop-down menu.

Note that you can change the way folder and file icons appear in the dialog box. To do so, use the slider attached to the Change Your View drop-down list button located on the right side of the toolbar at the top of the Open dialog box. When you select Large Icons or Extra Large Icons on this slider (or anywhere in between), the Excel workbook icons actually show data in the upper-left corner of the first worksheet. This applies to all Excel workbooks saved with the Save Thumbnail check box selected and Excel 97 through 2003 workbooks saved with the Save Preview Picture check box on the Summary tab of the workbook's Properties dialog box selected. This preview of part of the first sheet helps you quickly identify the workbook you want to open for editing or printing.

TIP If you're comfortable opening workbook files directly from the Open dialog box, you can completely bypass the Open screen by selecting the Don't Show the Backstage When Opening or Saving Files check box on the Save tab of the Excel Options dialog box (Alt + FTS). Just be aware that when you select this check box, Excel not only immediately displays the Open dialog box when you choose File ⇒ Open to open a workbook file for editing but also displays the Save As dialog box when you choose File ⇒ Save option (or any of its equivalents) to save a new workbook file. This means that you must be as comfortable using the Save As dialog box to select the place to save a new file as you are using the Open dialog box to select the place containing the file to edit.

Opening more than one workbook at a time

If you know that you need to edit worksheets saved in multiple workbook files, you can open them all in Excel at the same time by selecting all their files in the Folder and File List in the Open dialog box before you select the Open button.

REMEMBER To select multiple files that appear sequentially in the Open dialog box, click the first file and then hold down the Shift key while you click the last file. To select files that aren't listed sequentially, click the first file and then hold down the Ctrl key while you click the other files.

After the workbook files are open in Excel, you can then switch documents by selecting their filename buttons on the Windows taskbar or by using the Flip feature (Alt + Tab) to select the workbook's thumbnail. (See Book 2, Chapter 4 for more information on working on more than one worksheet at a time.)

Finding misplaced workbooks

Everything's hunky-dory as long as you correctly remember the folder containing the workbook file or files you need to edit. But what about those times when they seem to have mysteriously migrated and are now nowhere to be found? For those rare occasions, use the Search Documents text box in the Open dialog box (see Figure 3-3) that enables you to search for missing notebooks right from within the dialog box.

To use this search feature to find a workbook, click the Search Documents text box in the upper-right corner of the Open dialog box and then begin typing search characters used in the workbook's filename or contained in the workbook itself.

As Windows finds any matches for the characters you type, the names of the workbook files (and other Excel files such as templates and macro sheets as well) appear in the Open dialog box. As soon as the workbook you want to open is listed, you can open it by clicking its icon and filename followed by the Open button or by double-clicking it.

Using the other Open options

The drop-down menu attached to the Open button in the Open dialog box enables you to open the selected workbook file(s) in special ways. These ways include

- **Open Read-Only:** Opens the files you select in the Open dialog box's list box in a read-only state, which means that you can look but you can't touch. (Actually, you can touch; you just can't save your changes.) To save changes in a read-only file, you must choose File ⇒ Save As from the Excel menu bar and give the workbook file a new filename, a new location, or both.
- **Open as Copy:** Opens a copy of the files you select in the Open dialog box. Use this method of file opening as a safety net: If you mess up the copies, you always have the originals to fall back on.
- **Open in Browser:** Opens workbook files you save as web pages in your default web browser. Note that this command isn't available unless the program identifies that the selected file or files were saved as web pages rather than plain, old Excel worksheet files.
- **Open in Protected View:** Opens the selected workbook in Protected View, which prevents you from making any editing changes to its worksheets until you click the Enable Editing button that appears in the red Protected View panel at the top of the worksheet area.
- **Open and Repair:** Attempts to repair corrupted workbook files before opening them in Excel. When you select this command, a

dialog box appears, giving you a choice between attempting to repair the corrupted file or opening the recovered version, extracting the data out of the corrupted file, and placing it in a new workbook (which you can save with the Save command). Click the Repair button to attempt to recover and open the file. Click the Extract Data button if you previously tried unsuccessfully to have Excel repair the file.

- **Show Previous Versions:** Displays a list of various versions of the workbook file automatically saved by Excel's AutoRecover feature and given filenames that describe when the file and under what circumstances the version was saved.

Editing a Cell

The biggest thing to remember about basic cell editing is that you have to put the cell pointer (also known as the cell cursor) on the cell you want to modify. When modifying a cell's contents, you can replace the entry entirely, delete characters from the entry, and/or insert new characters into the entry:

- **Replacing a cell's contents:** Select the cell, type your new entry, and then press Enter (or use whatever completion technique you prefer). Excel replaces the existing data entry with your typing. While you're typing the new entry, you can cancel the replacement and restore the original cell entry by clicking the Formula bar's Cancel button or by pressing Escape.
- **Deleting characters in a cell entry:** Open the cell for editing by selecting the cell and pressing F2 or by double-clicking the cell. Either technique puts Excel into Edit mode (indicated by Edit on the status bar). Alternatively, select the cell and click inside the Formula bar. You now have an insertion point cursor either inside the cell or in the Formula bar. Use the Home, End, or ← and → keys to move the insertion point to the right of the first character you want to delete, and press Backspace until you've removed all the unnecessary or incorrect characters. (Alternatively, move the insertion point to the left of the first character you want to delete, and then press Delete until you've removed all the characters you no longer need.)
- **Inserting new characters in a cell entry:** Open the cell for editing by selecting the cell and pressing F2 or by double-clicking the cell. Either technique puts Excel into Edit mode (indicated by Edit on the status bar). Alternatively, select the cell and click

inside the Formula bar. You now have an insertion point cursor either inside the cell or in the Formula bar. Use the Home, End, or ← and → keys to move the insertion point to the location in the entry where you want to insert the new characters and then start typing.

REMEMBER When you edit the contents of a cell by inserting and/or deleting characters in it, you need to remember to click the Enter button on the Formula bar or press the Enter key to complete the editing change and switch the program from Edit back to Ready mode (indicated by the reappearance of Ready on the status bar). If you're editing a cell with a simple text or number entry, you can also complete your edits by clicking another cell. (However, clicking another cell doesn't work when you're editing a formula because Excel just includes the address of the cell that you click as part of the edited formula.) Also, you can't use any of the keystrokes that normally complete a new cell entry except for the Tab and Shift + Tab keystrokes for moving to the next and previous columns in the worksheet. (All the rest, including the arrow keys, Home, and End, just move the insertion point within the cell entry.)

Changing your mind with Undo and Redo

Excel supports multiple levels of undo that you can use to recover from potentially costly editing mistakes that would require data re-entry or extensive repair operations. The most important thing to remember about the Undo command is that it is cumulative, meaning that you may have to select it multiple times to reverse several actions that you've taken before you get to the one that sets your worksheet right again.

You can select the Undo command either by clicking the Undo button on the Quick Access toolbar or by pressing Alt + Backspace or Ctrl + Z. Excel then reverses the last edit you made in the worksheet. For example, if you edit a cell entry and erase some of its text in error, clicking Undo restores the characters that you just erased to the entry. Likewise, if you delete a group of cells by mistake, clicking Undo restores the cells — including both the cell contents and the cell formatting — to the worksheet.

On the Quick Access toolbar, you can click the drop-down button attached to the Undo command button (or press Alt+3) to display a menu of the actions that you've recently taken in the worksheet. Instead of undoing one action at a time, you undo multiple actions by clicking the last of the actions you want to undo in the drop-down menu. As soon as you release the mouse button, Excel then restores the worksheet to the state that it was in before you took all the actions that you chose from this drop-down menu.

When you make an editing change in a worksheet, the Undo item on the Undo button's drop-down menu actually changes to reflect the action that you just took. For example, if you clear a group of cells by pressing the Delete key and then open the Undo button's drop-down menu, the first item on the Undo menu appears as follows:

```
Clear
```

If you then apply new formatting to a cell selection, such as assigning a new center alignment, and then open the Undo drop-down menu, the first item on the Undo menu now appears as follows:

```
Center Alignment
```

WARNING The Undo feature works by storing a "snapshot" of the worksheet in the memory of your computer at each stage in its editing. Sometimes, if you attempt a large-scale edit in a worksheet, Excel determines that sufficient free memory doesn't exist to hold a snapshot of the worksheet in its current state and complete the planned editing change as well. For example, this can happen if you try to cut and paste a really large range in a big worksheet. In such a case, Excel displays an Alert dialog box that indicates a lack of enough memory and asks whether you want to continue without Undo. If you then select the Yes option, Excel completes the planned edit but without the possibility of you being able to reverse its effects with Undo. Before you take such an action, consider how much time and effort would be required to manually restore the worksheet to its previous state if you make a mistake in carrying out your editing change.

After you use the Undo feature to reverse an editing change, the Redo button on the Quick Access toolbar becomes active. The Redo command item on the Redo button's drop-down menu has the name of the latest type of editing that you just reversed with the Undo button, such as Redo Clear when the last action you took was to restore a cell entry that you just deleted.

You use the Redo command to restore the worksheet to the condition that it was in before you last clicked the Undo command. As with using the Undo button on the Quick Access toolbar, when you click the drop-down button attached to the Redo button, you can repeat multiple actions by clicking the last of the actions you want repeated (assuming that you used the Undo command multiple times). You can also restore edits that you've undone one at a time by pressing Ctrl+Y.

TIP

EDITING IN THE CELL VERSUS ON THE FORMULA BAR

When doing simple editing to a cell's contents, you may wonder whether it's better to edit the contents in the cell directly or edit the contents in the Formula bar. When editing short entries that fit entirely within the current column width, it really is a matter of personal choice. Some people prefer editing on the Formula bar because it's out of the way of other cells in the same region of the worksheet. Other people prefer editing on the Formula bar because they find it easier to click the insertion point with the I-beam mouse pointer at precisely the place in the entry that needs editing. (When you press F2 to edit in the cell, Excel always positions the insertion point at the very end of the entry, and when you double-click in the cell, you really can't tell exactly where you're putting the insertion point until you finish double-clicking, at which time you see the flashing insertion point.)

When it comes to editing longer cell entries (that is, text entries that spill over into empty neighboring cells, and numbers that, if their digits weren't truncated by the number format assigned, wouldn't fit within the current cell width), you probably will want to edit their contents on the Formula bar. You can click the Formula Bar button (the carat symbol turned downward) to display the entire contents of the cell without obscuring any of the cells of the worksheet.

TIP You can use Undo and Redo to toggle between a Before and After view of your worksheet. For example, suppose that you update an entry in a cell that was used in formulas throughout a data table. As soon as you enter the new number in this cell, Excel recalculates the table and displays the new results. To once again view the original version of the table before you make this latest change, you use Undo (Ctrl + Z). After checking some values in the original table, you then restore the latest change to its numbers by clicking the Redo command (Ctrl + Y). You can then continue in this manner as long as you want, switching between Before and After versions by holding down the Ctrl key as you press Z and then press Y, alternating between Undo and then Redo.

Clearing cells

Sometimes you need to delete an entry that you made in a cell of the worksheet without replacing it with any other contents. Excel refers to this kind of deletion as *clearing* the cell. This is actually more correct than referring to it as “emptying” the cell because although the cell may appear empty when you delete its contents, it may still retain the formatting assigned to it, and therefore it isn’t truly empty.

For this reason, clicking the Home tab's Clear button (the one with the eraser icon in the Editing group) or pressing Alt + HE opens a drop-down menu with these options:

- **Clear All:** Gets rid of both the contents and the formatting assigned to the current cell selection.
- **Clear Formats:** Removes only the formatting assigned to the current cell selection without getting rid of the contents.
- **Clear Contents:** Gets rid of only the contents in the current cell selection without getting rid of the formatting assigned to it. (This is the equivalent of pressing the Delete key.)
- **Clear Comments:** Removes only the comments assigned to the cells in the selection without touching either the contents or the formatting.
- **Clear Hyperlinks:** Displays the Clear Hyperlinks button below and to the right of the selection. Click that button and then click either

Clear Hyperlinks Only (which removes the hyperlinks without also removing the hyperlink formatting) or Clear Hyperlinks and Formats (which removes both the hyperlinks and the hyperlink formatting).

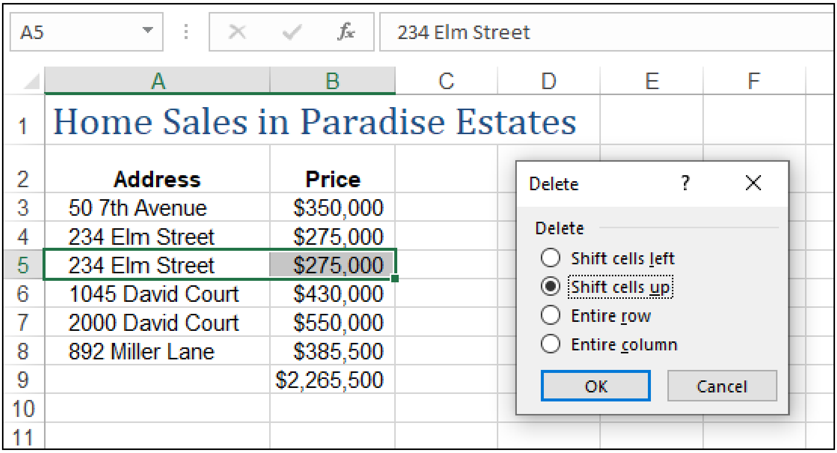
- **Remove Hyperlinks**: Removes the hyperlink and its formatting.

The Clear All option is great when you need to truly empty a cell of all formatting and contents while at the same time retaining that empty cell in the worksheet. However, what about when you need to get rid of the cell as well as all its contents? For example, suppose that you entered a column of numbers that you've totaled with a summing formula only to discover that midway in the list, you entered the same number twice, in one cell above the other. You don't want to just clear the duplicate number in one of the two cells, thus leaving a single empty cell in the middle of your list of values. Having an empty cell in the middle of the list won't skew the total, but it won't look professional!

In this case, you want to both clear the duplicate entry and remove the newly emptied cell while at the same time pulling up the cells with the rest of the numbers in the list below along with the cell at the end that contains the formula that sums the values together. Excel offers just such a command on the Home tab in the form of the Delete button and its drop-down menu. When you click Delete Cells from the Delete button's drop-down menu (or press Alt+HDD), the Delete dialog box appears, similar to the one shown in Figure 3-4 (sample workbook: Home Sales.xlsx). This dialog box lets you choose how you want the remaining cells to be shifted when the selected cell (or cells) is removed from the worksheet.

REMEMBER When you use the Delete Cells option, Excel zaps everything, including the contents, formatting, and any and all attached comments. Don't forget about the Undo button on the Quick Access toolbar or Ctrl+Z in case you ever zap something you shouldn't have!

Figures 3-4 and 3-5 (sample workbook: Home Sales.xlsx for both) illustrate how Delete Cells works in the example where a duplicate entry has been mistakenly entered in a column of numbers that is totaled by a summing formula. In Figure 3-4, I selected cells A5:B5, which contain duplicate entries, before clicking the Delete button's drop-down button and then clicking Delete Cells from its drop-down menu to display the Delete dialog box.



A5

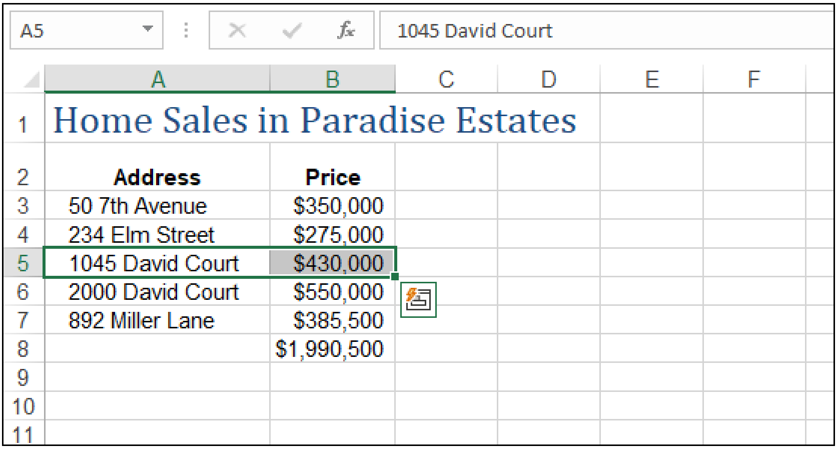
234 Elm Street

	A	B
1	Home Sales in Paradise Estates	
2	**Address**	**Price**
3	50 7th Avenue	$350,000
4	234 Elm Street	$275,000
5	234 Elm Street	$275,000
6	1045 David Court	$430,000
7	2000 David Court	$550,000
8	892 Miller Lane	$385,500
9		$2,265,500
10		
11		

Delete

○ Shift cells left
● Shift cells up
○ Entire row
○ Entire column

FIGURE 3-4: When you select Delete Cells, Excel asks how you want the remaining cells to be shifted. (Sample workbook: Home Sales.xlsx)



A5

1045 David Court

	A	B
1	Home Sales in Paradise Estates	
2	**Address**	**Price**
3	50 7th Avenue	$350,000
4	234 Elm Street	$275,000
5	1045 David Court	$430,000
6	2000 David Court	$550,000
7	892 Miller Lane	$385,500
8		$1,990,500
9		
10		
11		

FIGURE 3-5: Worksheet after deleting the cell with the duplicate entry. (Sample workbook: Home Sales.xlsx)

When the Delete dialog box opens, the Shift Cells Left option is automatically selected. That's not what I want here. Instead, I want Excel to shift the remaining cells up to fill in the blank cells, so that's why I've selected the Shift Cells Up option in Figure 3-4. Figure 3-5 shows the same worksheet after clicking OK in the Delete dialog box. Notice how Excel pulled up the entries in the cells below when it deleted the duplicate in cell B5, while at the same time automatically recalculating the summing formula to reflect the total of the remaining entries.

WARNING Don’t confuse the use of the Delete key and the Delete Cells command. When you press the Delete key, Excel automatically deletes just the contents of the cells that are selected (keeping the cell formatting intact), leaving seemingly blank cells in the worksheet. When you click Delete Cells from the Delete button’s drop-down menu, Excel displays the Delete dialog box, which deletes the selected cells and then shifts the remaining cells in the direction that you designate (up or to the left) to fill in what would otherwise be blank cells.

TIP If you know that you want to use the Shift Cells Up option when deleting the current cell selection, you don’t have to bother with opening the Delete dialog box at all: Click the Delete button (rather than its drop-down button), and Excel instantly deletes the selection and pulls up all remaining cells.

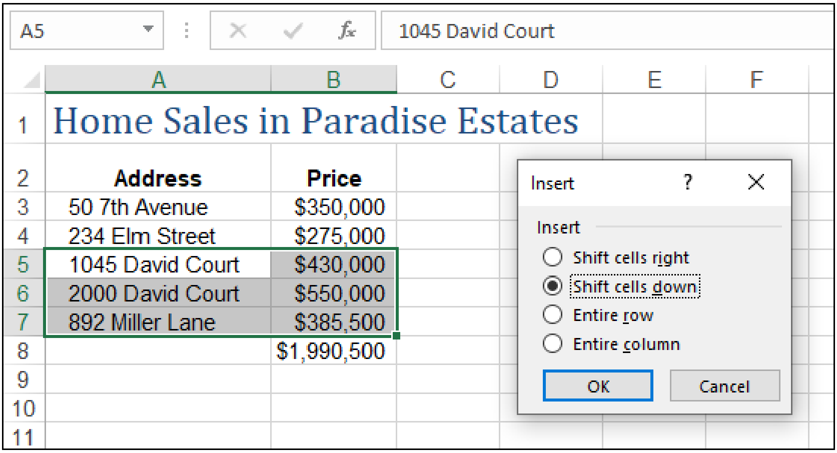
Inserting cells

The Home tab's Insert command (it's in the Cells group) is the opposite of the Delete button immediately below it. That is, rather than removing cells for your worksheet, you use Insert to create new cells in your worksheet.

For example, suppose that you discover that you’ve left out three numbers from a column of summed numbers and that these values should have appeared in the middle of the column. You could shift the bottom half of the column down three cells to create some room, but that can be a pain if you're dealing with a long column of values. Instead, you can use the Insert command to get Excel to do the work for you.

To make this edit, select the first data row that needs to be shifted down to make room for the missing entries. If you were just inserting a single entry, you can leave it at that. However, to let Excel know how many rows you want to insert, you drag the selection down until you've selected the number of rows you want inserted. For example, you'd select three rows if you wanted to insert three entries.

Figures 3-6 and 3-7 (sample workbook: Home Sales.xlsx for both) illustrate this situation. In Figure 3-6, I selected the cell range A5:B7, where cells for the three missing entries are to be inserted. I then clicked the drop-down button on the Insert button followed by Insert Cells on its drop-down menu. The Insert dialog box opens with the Shift Cells Right option button selected. Because I needed to have the cells in the selected range moved down to make room for the missing entries, I then selected the Shift Cells Down option.

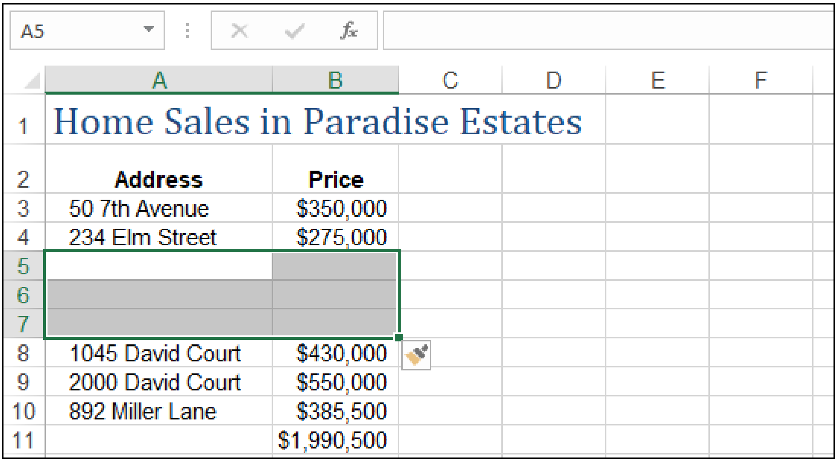

A5 | 1045 David Court

	A	B	C	D	E	F
1	Home Sales in Paradise Estates					
2	**Address**	**Price**				
3	50 7th Avenue	$350,000				
4	234 Elm Street	$275,000				
5	1045 David Court	$430,000				
6	2000 David Court	$550,000				
7	892 Miller Lane	$385,500				
8		$1,990,500				
9						
10						
11						

Insert

Insert
○ Shift cells right
● Shift cells down
○ Entire row
○ Entire column

FIGURE 3-6: Inserting three blank cells for missing entries in two columns of a table while shifting the existing entries down. (Sample workbook: Home Sales.xlsx)



	A	B	C	D	E	F
1	Home Sales in Paradise Estates					
2	Address	Price				
3	50 7th Avenue	$350,000				
4	234 Elm Street	$275,000				
5						
6						
7						
8	1045 David Court	$430,000				
9	2000 David Court	$550,000				
10	892 Miller Lane	$385,500				
11		$1,990,500				

FIGURE 3-7: The worksheet table after entering the missing entries in the newly inserted blank cells. (Sample workbook: Home Sales.xlsx)

After clicking OK in the Insert dialog box, Excel moves down the existing entries as shown in Figure 3-7. This leaves the previously occupied range A5:B7 with three blank data rows, where I can input my missing entries.

TIP

If you know that you want to move existing cells down with the Shift Cells Down option when inserting new cells in the current cell selection, you don't have to bother with opening the Insert dialog box at all: Click the Insert button (rather than its drop-down button), and Excel instantly inserts new cells while moving the existing ones down.

A Worksheet with a View

Excel provides a number of features that can help you find your way and keep your place in the worksheet that needs editing. Among these are its Zoom feature, which enables you to increase or decrease the magnification of the worksheet window, thus making it possible to switch from a really up-close view to a really far-away view in seconds, and its Freeze Panes feature, which enables you to keep pertinent information, such as column and row headings, on the worksheet window as you scroll other columns and rows of data into view.

Zooming in and zooming back out again

Excel enables you to change the magnification of the active worksheet window with its Zoom slider feature on the Status bar in the lower-right corner of the window. The Zoom slider contains two buttons, one on either end:

- **Zoom Out (-):** Reduces the worksheet area's magnification percentage by 10 percent each time you click the button.
- **Zoom In (+):** Increases the worksheet area's magnification percentage by 10 percent each time you click the button.

You can also quickly change the worksheet area's magnification percentage (and thus zoom out and in on the data) by dragging the slider's button to the left or right.

REMEMBER When you first open the worksheet, the Zoom slider button is always located in the very center of the Zoom slider, putting the worksheet area magnification at 100% (the normal screen, depending upon your computer monitor's screen resolution). As you click the Zoom Out or Zoom In button or drag the slider button, Excel keeps you informed of the current magnification percentage by displaying it to the immediate right of the Zoom In button on the status bar. Note too, that 10% is the lowest percentage you can select by dragging the button all the way to the left on the slider, and 400% is the highest percentage you can select by dragging the button all the way to the right.

TIP On a touchscreen device, you can use your fingers to zoom in and out on a worksheet. Stretch your forefinger and thumb out to zoom in on the cells and pinch them together to zoom out. As you do, the Zoom slider on the Status bar shows you the current zoom percentage and moves the slider right or left to follow your stretch or pinch gesture.

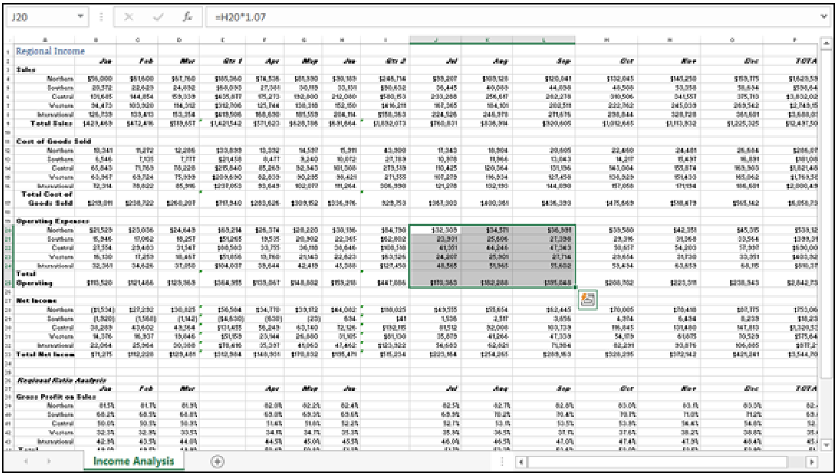
Although the Zoom slider is always available on the Status bar in any worksheet you have open, you can also change the worksheet area's magnification percentage via the Ribbon: on the View tab, click the Zoom button (or press Alt+WQ). Excel opens the Zoom dialog box, where you have three ways to change the Zoom level:

- Select one of the preset magnification percentages: 200%, 100%, 75%, 50%, or 25%.
- Select the Custom option and then use the Custom text box to enter any magnification percentage between a minimum of 10% and a maximum of 400%.
- Select the Fit Selection option to have Excel change the magnification so that the selected cell range takes up the entire height or width of the worksheet area. Alternatively, select your cell range, and then click the View tab's Zoom to Selection button.

TIP

If the device you're running Excel on is equipped with a physical mouse with a wheel in between the two mouse buttons), you can configure Excel so that rolling the wheel back and forth zooms out and in on the current worksheet. To do this, display the Advanced tab of the Excel Options dialog box (File ⇒ Options ⇒ Advanced or Alt+FTA), and then click the Zoom on Roll with IntelliMouse check box in the Editing Options section. Now, instead of scrolling up the rows of the worksheet, rolling the wheel forward increases the magnification (by 15% until you reach the maximum 400%); instead of scrolling down the rows of the sheet, rolling the wheel backward decreases the magnification (by 15% until you reach the minimum 10% value).

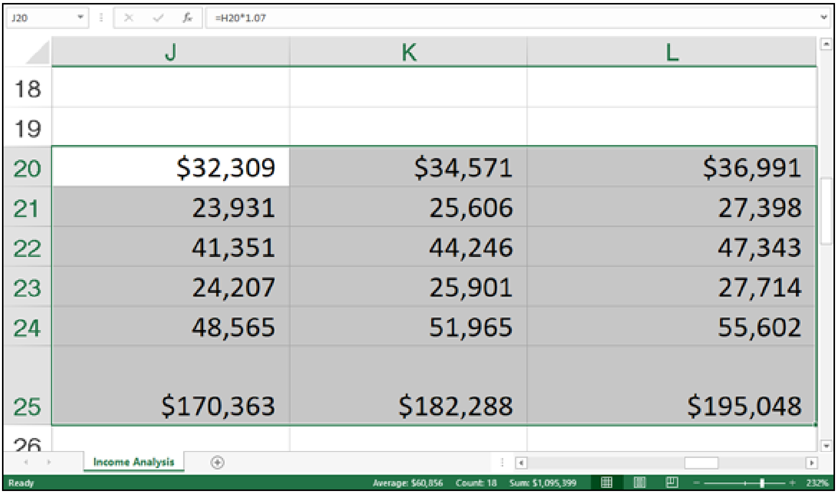
Figures 3-8 and 3-9 (sample workbook: Income Analysis.xlsx for both) illustrate how you can use the Zoom feature to first zoom out to locate a region in a large worksheet that needs editing and then zoom in on the region to do the editing. In Figure 3-8, I zoomed out on the Income Analysis to display all its data by selecting a 50% magnification setting. At the 50% setting, I could just barely make out the headings and read the numbers in the cells. I then located the cells that needed editing and selected their cell range (J20:L25) in the worksheet.



J20

=H20*1.07

FIGURE 3-8: The Income Analysis worksheet after zooming out to a 50% magnification setting. (Sample workbook: Income Analysis.xlsx)



J20

=H20*1.07

	J	K	L
18			
19			
20	$32,309	$34,571	$36,991
21	23,931	25,606	27,398
22	41,351	44,246	47,343
23	24,207	25,901	27,714
24	48,565	51,965	55,602
25	$170,363	$182,288	$195,048
26			

Ready

Average: $60,856 Count: 18 Sum: $1,095,399

232%

FIGURE 3-9: Worksheet at 232% magnification after zooming in on the cell range J20:L25. (Sample workbook: Income Analysis.xlsx)

I then clicked the Zoom to Selection command button on the View tab, and Figure 3-9 shows the result. As you can see on the Status bar, Excel boosted the magnification from 50% up to 232% to get the range to fit (in this case) the width of the worksheet area.

TIP Because Excel immediately puts the slider button at whatever point you click, you can instantly return the magnification percentage to the normal 100% after selecting any other magnification. Click the line at the midpoint in the Zoom slider on the Status bar. Alternatively, in the View tab's Zoom group, click the 100% button.

Freezing window panes

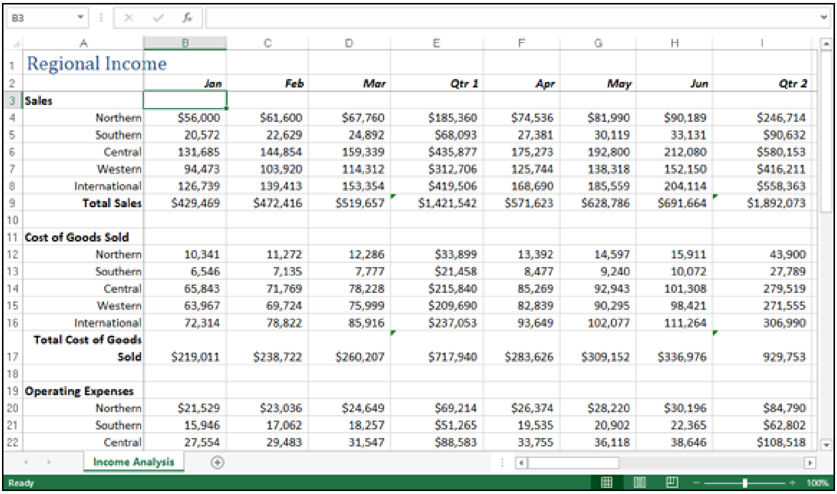
Excel's Freeze Panes feature enables you to specify one or more rows and/or columns that stay put while you scroll the worksheet. For example, if you freeze row 1 (the top row) of the worksheet, the data in that row remains visible no matter how far down you scroll in the worksheet. Similarly, if you freeze column A (the leftmost column) of the worksheet, the data in that column remains visible no matter how far right you scroll in the worksheet.

How is this useful? Well, Figure 3-9 could be the poster child for the Freeze Panes feature. Although zooming in on the range of cells that needs editing makes their data entries more readable, it also removes all the column and row labels that enable you to figure out what data you're looking at. If I had used the Freeze Panes command to freeze column A with the row labels and row 2 with the column labels, they would remain displayed on the screen — regardless of the magnification settings that I select or how I scroll through the cells.

To use the Freeze Panes feature in this manner, you first position the cell pointer in the cell that's located to the immediate right of the column or columns that you want to freeze and immediately beneath the row or rows that you want to freeze. Now, in the View tab's Window group, select Freeze Panes to drop down the menu, and then select the Freeze Panes command. (You can also select the Freeze Panes command by pressing Alt+WFF.)

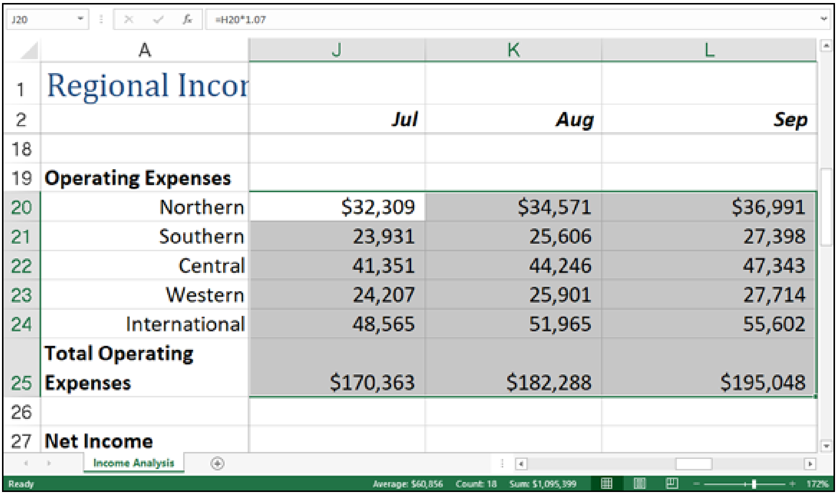
TIP To freeze the top row of the worksheet (assuming that it contains column headings) from anywhere in the worksheet (it doesn't matter where the cell cursor is), display the View tab and choose Freeze Panes ⇒ Freeze Top Row. If you want to freeze the first column (assuming that it contains row headings) from anywhere in the worksheet, display the View tab and choose Freeze Panes ⇒ Freeze First Column.

Figures 3-10 and 3-11 (sample workbook: Income Analysis.xlsx for both) illustrate how this works. Figure 3-10 shows the Income Analysis worksheet after freezing column A and rows 1 and 2. To do this, I positioned the cell cursor in cell B3 before choosing Freeze Panes from the Freeze Panes button's drop-down menu. Notice the thin black line that runs down column A and across row 2, marking which column and rows of the worksheet are frozen on the display and that now remain in view — regardless of how far you scroll to the right to new columns or scroll down to new rows.



	A	B	C	D	E	F	G	H	I
1	Regional Income								
2		*Jan*	*Feb*	*Mar*	*Qtr 1*	*Apr*	*May*	*Jun*	*Qtr 2*
3	**Sales**								
4	Northern	$56,000	$61,600	$67,760	$185,360	$74,536	$81,990	$90,189	$246,714
5	Southern	20,572	22,629	24,892	$68,093	27,381	30,119	33,131	$90,632
6	Central	131,685	144,854	159,339	$435,877	175,273	192,800	212,080	$580,153
7	Western	94,473	103,920	114,312	$312,706	125,744	138,318	152,150	$416,211
8	International	126,739	139,413	153,354	$419,506	168,690	185,559	204,114	$558,363
9	**Total Sales**	$429,469	$472,416	$519,657	$1,421,542	$571,623	$628,786	$691,664	$1,892,073
10									
11	**Cost of Goods Sold**								
12	Northern	10,341	11,272	12,286	$33,899	13,392	14,597	15,911	43,900
13	Southern	6,546	7,135	7,777	$21,458	8,477	9,240	10,072	27,789
14	Central	65,843	71,769	78,228	$215,840	85,269	92,943	101,308	279,519
15	Western	63,967	69,724	75,999	$209,690	82,839	90,295	98,421	271,555
16	International	72,314	78,822	85,916	$237,053	93,649	102,077	111,264	306,990
17	**Total Cost of Goods Sold**	$219,011	$238,722	$260,207	$717,940	$283,626	$309,152	$336,976	929,753
18									
19	**Operating Expenses**								
20	Northern	$21,529	$23,036	$24,649	$69,214	$26,374	$28,220	$30,196	$84,790
21	Southern	15,946	17,062	18,257	$51,265	19,535	20,902	22,365	$62,802
22	Central	27,554	29,483	31,547	$88,583	33,755	36,118	38,646	$108,518

FIGURE 3-10: The income worksheet after freezing column A and rows 1:2 in the worksheet display. (Sample workbook: Income Analysis.xlsx)



J20 =H20*1.07

	A	J	K	L
1	Regional Incor			
2		*Jul*	*Aug*	*Sep*
18				
19	**Operating Expenses**			
20	Northern	$32,309	$34,571	$36,991
21	Southern	23,931	25,606	27,398
22	Central	41,351	44,246	47,343
23	Western	24,207	25,901	27,714
24	International	48,565	51,965	55,602
25	**Total Operating Expenses**	$170,363	$182,288	$195,048
26				
27	**Net Income**			

Ready Average: $60,856 Count: 18 Sum: $1,095,399

FIGURE 3-11: The income worksheet after zooming in on the cell range J20:L25 after freezing panes. (Sample workbook: Income Analysis.xlsx)

As Figure 3-11 shows, frozen panes stay on the screen even when you zoom in and out on the worksheet. For Figure 3-11, I repeated the steps I took in changing the magnification for Figures 3-8 and 3-9 (only this time with the frozen panes in place). First, I zoomed out on the Income Analysis worksheet by dialing the 50% magnification setting on the Zoom slider; second, I selected the range J20:L25 and then clicked the Zoom to Selection button on the View tab.

Figure 3-11 shows the result. Note that with the frozen panes in place, this time Excel only selected a 172% magnification setting instead of the original 232% setting. This lower magnification setting is worth it because all the important information has been added to the cell range.

TIP

When you press the Ctrl + Home shortcut key after you've frozen panes in a worksheet, instead of positioning the cell cursor in cell A1 as normal, Excel positions the cell cursor in the first unfrozen cell. In the example illustrated in Figure 3-10, pressing Ctrl + Home from anywhere in the worksheet puts the cell cursor in B3. From there, you can position the cell cursor in A1 either by clicking the cell or by pressing the arrow keys.

To unfreeze the panes after you've finished editing, click the Unfreeze

Panes option on the Freeze Panes button's drop-down menu. (This option replaces Freeze Panes at the top of the menu.)

Saving custom views

In the course of creating and editing a worksheet, you may find that you need to modify the worksheet display many times as you work with the document. For example, you may find at some point that you need to reduce the magnification of the worksheet display to 75% magnification. At another point, you may need to return to 100% magnification and hide different columns in the worksheet. At some later point, you may have to redisplay the hidden columns and then freeze panes in the worksheet.

Excel's Custom Views feature enables you to save any of these types of changes to the worksheet display. This way, instead of taking the time to manually set up the worksheet display that you want, you can have Excel re-create it for you by selecting the view. When you create a view, Excel can save any of the following settings: the current cell selection, print settings (including different page setups), column widths and row heights (including hidden columns), display settings on the Advanced tab of the Excel Options dialog box, as well as the current position and size of the document window and the window pane arrangement (including frozen panes).

To create a custom view of your worksheet, follow these steps:

1. **Make all the necessary changes to the worksheet display so that the worksheet window appears exactly as you want it to appear each time you select the view. Also select all the print settings on the Page Layout tab that you want used in printing the view. (See Book 2, Chapter 5 for details.)**
2. **In the View tab's Workbook Views group, click the Custom Views button (or press Alt+WC).**

   Excel opens the Custom Views dialog box, similar to the one shown in Figure 3-12.
3. **Click Add.**

   Excel opens the Add View dialog box.
4. **Enter a unique and descriptive name for your view in the Name text box.**

   Make sure that the name you give the view reflects all its pertinent settings.

5. **To include print settings and hidden columns and rows in your view, leave the Print Settings and Hidden Rows, Columns and Filter Settings check boxes selected. If you don't want to include these settings, clear the check mark from either one or both of these check boxes.**
6. **Click OK.**

   When you click OK, Excel closes both the Add View and Custom Views dialog boxes. When you next open the Custom Views dialog box, the name of your new view appears in the Views list box.

   Custom views are saved as part of the workbook file. To be able to use them whenever you open the worksheet for editing, you need to save the workbook with the new view.
7. **Click the Save button on the Quick Access toolbar or press Ctrl + S to save the new view as part of the workbook file.**

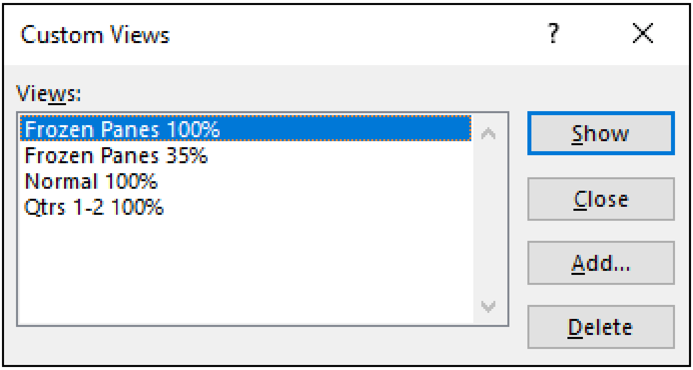


FIGURE 3-12: The custom views you create appear in the Custom Views dialog box.

After you create your views, you can display the worksheet in that view at any time while working with the worksheet. To display a view, follow these steps:

1. **In the View tab's Workbook Views group, click Custom Views (or press Alt + WC).**

2. **In the Views list box, either double-click the name of the view that you want to use or click the name and then click Show.**

TIP

Always start by defining a Normal 100% view in the Custom Views dialog box that represents the standard view of the worksheet before you go about defining custom views that hide columns, freeze panes, and mess with the worksheet's magnification. This way, you can recover from a special view (especially one that you only use in printing part of the worksheet but never use when editing it) by double-clicking Normal 100% in the Views list box of the Custom Views dialog box.

Copying and Moving Stuff Around

Moving and copying worksheet data are among the most common editing tasks that you perform when editing a typical worksheet. Excel offers two basic methods for moving and copying a cell selection in a worksheet: First, you can use drag-and-drop to place the cells in a new location; second, you can cut or copy the contents to the Clipboard and then paste them into the desired area. Moving and copying data to new areas in a worksheet are basically very straightforward procedures. You need to keep a few things in mind, however, when rearranging cell entries in a worksheet:

- When you move or copy a cell, Excel moves everything in the cell, including the contents, formatting, and any note assigned to the cell. (See Book 4, Chapter 2, for information on adding notes to cells.)

- If you move or copy a cell so that it overlays an existing entry, Excel replaces the existing entry with the contents and formatting of the cell that you're moving or copying. This means that you can replace existing data in a range without having to clear the range before moving or copying the replacement entries. It also means that you must be careful not to overlay any part of an existing range that you don't want replaced with the relocated or copied cell entries.

- When you move cells referred to in formulas in a worksheet, Excel automatically adjusts the cell references in the formulas to reflect their new locations in the worksheet.

- When you copy formulas that contain cell references, Excel automatically adjusts the cell references in the copies relative to the change in their position in the worksheet. (See Book 3, Chapter 1 for details on copying formulas in a worksheet.)

REMEMBER For situations in which you need to copy only a single data entry to cells in a single row or to cells in a single column of the worksheet, you can use AutoFill to extend the selection left or right or up or down by dragging the fill handle. (See Book 2, Chapter 1 for information about using AutoFill to extend and copy a cell entry.)

Copying and moving with drag-and-drop

Drag-and-drop provides the most direct way to move or copy a range of cells in a single worksheet. To move a range, select the cells, position the pointer on any one of the edges of the range (the pointer's cursor changes to a white arrowhead pointing to the center of a black cross with four black arrowheads), drag the range to its new position in the worksheet, and then release the mouse button.

REMEMBER Note that it can be a real drag to use drag-and-drop to copy or move a cell selection when the first cell of the range into which the cells are being copied or moved is far away in an unseen part of the Excel worksheet area. To make moving or copying easier in this scenario, set up two windows in the worksheet area: one that displays the cells that you're moving or copying and another that displays the worksheet area into which you want to move or copy the cells. (See Book 2, Chapter 4 for information on setting up windows that enable this.) When you don't have such windows set up, use the cut-and-paste method (as described in the later section, "Copying and moving with copy, cut, and paste") to make distant moves and copies.

TIP You can use drag-and-drop with a stylus on your touchscreen device if it’s so equipped. If you’re using your finger, however, you must tap the cell selection and then use the Cut or Copy option followed by the Paste option on the mini-toolbar that appears. (See “Copying and moving with copy, cut, and paste,” later in this chapter.)

When you use drag-and-drop with a stylus, Excel displays a pop-up menu when you release the rectangular outline indicating where the range is to be moved or copied in a new area of the worksheet by removing the stylus’ pointer from the touchscreen. You then select between the Move Here and Copy Here options on this pop-up menu to complete the move or copy operation.

Moving cells with drag-and-drop

As you drag a cell range using drag-and-drop, Excel displays only the outline of the range with a ScreenTip that keeps you informed of its new cell or range address. After you’ve positioned the outline of the selected range so that the outline surrounds the appropriate cells in a new area of the worksheet, release the mouse button or your finger or stylus from the touchscreen. Excel moves the selected cells (including the entries, formatting, and comments) to this area.

If the outline of the cell selection that you’re dropping encloses any cells with existing data entries, Excel displays an Alert dialog box asking whether you want to replace the contents of the destination cells. If you click OK in this dialog box, the overlaid data entries are completely zapped when they’re replaced by the incoming entries. If you inadvertently overwrite useful data, not to worry: Immediately press Ctrl+Z (or click the Home tab's Undo command) to reverse the move and restore the zapped cells.

Copying cells with drag-and-drop

You can use drag-and-drop to copy cell ranges as well as to move them. To modify drag-and-drop so that the feature copies the selected cells rather than relocating them, hold down the Ctrl key when you position the mouse pointer on one of the edges of the selected range. Excel indicates that drag-and-drop is ready to copy rather than move the cell selection by changing the mouse pointer to an outline pointer with a small plus sign in the upper-right. When the pointer assumes this shape, drag the outline of the selected cell range to the desired position and release both the Ctrl key and mouse button.

Copying and moving with copy, cut, and paste

Given the convenience of using drag-and-drop, you may still prefer to use the more traditional cut-or-copy-and-paste method when moving or copying cells in a worksheet. This is especially true when running Excel on a touchscreen device that doesn’t have access to a mouse. Cut-or-copy-and-paste uses the Clipboard (a special area of memory shared by all Windows programs), which provides a temporary storage area for the data in your cell selection until you paste the selection into its new position in the worksheet. Here are the basic techniques:

- **Moving a cell selection:** Click the Home tab's Cut command (the one with the scissors icon) in the Clipboard group (or press Alt+HX, Ctrl+X, or Shift+Delete).
- **Copying a cell selection:** Click the Home tab's Copy command (with the two sheets of paper side by side immediately beneath the Cut button) in the Clipboard group (or press Alt+HC, Ctrl+C, or Ctrl+Insert).

When you cut or copy a selection to the Clipboard, Excel displays a marquee around the cell selection (sometimes called *marching ants*), and the following message appears on the status bar:

```
Select destination and press ENTER or choose Paste
```

To complete the move or copy operation, select the first cell in the range where you want the relocated or copied selection to appear and then press the Enter key, click the Home tab's Paste button, or press Alt+HV, Ctrl+V, or Shift+Insert. Excel then completes the move or copy operation, pasting the range as required, starting with the active cell. When selecting the first cell of a paste range, be sure that you have sufficient blank cells below and to the right of the active cell so that the range you’re pasting doesn’t overwrite any existing data that you don’t want Excel to replace.

WARNING Unlike when moving and copying a cell selection with drag-and-drop, the cut-and-paste method doesn’t warn you when it’s about to replace existing cell entries in cells that are overlaid by the incoming cell range — it just goes ahead and replaces them with nary a beep or an alert! If you find that you moved the selection to the wrong area or replaced cells in error, immediately click the Undo button on the Quick Access toolbar or press Ctrl + Z to restore the range to its previous position in the worksheet.

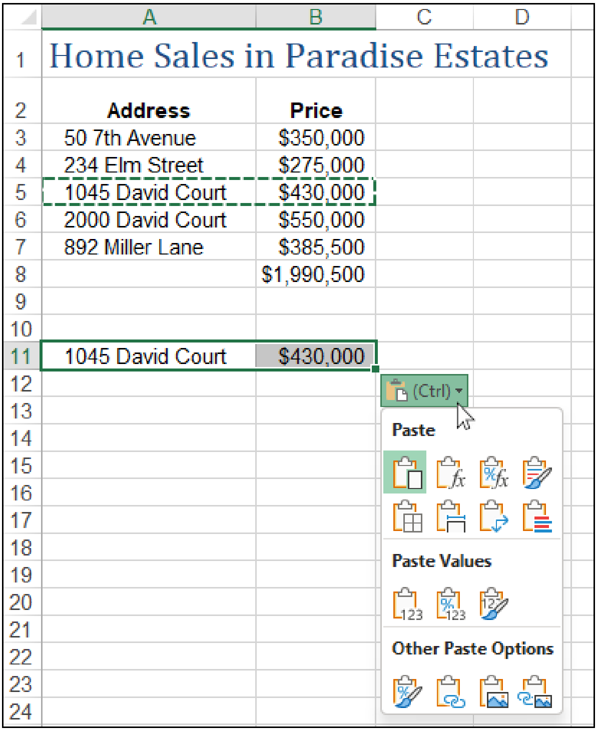
“Paste it again, Sam”

When you complete a copy operation with cut-and-paste by clicking the Paste button in the Clipboard group at the beginning of the Ribbon’s Home tab instead of pressing the Enter key, Excel copies the selected cell range to the paste area in the worksheet without removing the marquee from the original range. You can continue to paste the selection to other areas in the worksheet without having to recopy the cell range to the Clipboard. If you don’t need to paste the cell range in any other place in the worksheet, you can press Enter to complete the copy operation. If you don’t need to make further copies after using the Paste command, you can remove the marquee from the original selection by pressing the Escape or the Enter key.

Also, when you paste a cell selection that you’ve copied to the Clipboard (this doesn’t apply when pasting cells that you’ve cut to the Clipboard), Excel displays the Paste Options button in the lower-right corner of the cell selection (marked with the word Ctrl). When you position the mouse pointer over this Paste Options button (or press the Ctrl key), a palette of buttons divided into three sections (Paste, Paste Values, and Other Paste Options) appears as shown in Figure 3-13 (sample workbook: Home Sales.xlsx).

The buttons in these three sections of the Paste Options palette offer you the following choices for refining your paste operation. The eight buttons that appear in the Paste section are

- **Paste (P):** Excel pastes everything in the cell selection (text, values, formulas, and cell formatting).
- **Formulas (F):** Excel pastes all the text, numbers, and formulas in the current cell selection without their formatting.
- **Formulas & Number Formatting (O):** Excel pastes the number formats assigned to the copied values along with their formulas.



	A	B	C	D
1	Home Sales in Paradise Estates			
2	Address	Price		
3	50 7th Avenue	$350,000		
4	234 Elm Street	$275,000		
5	1045 David Court	$430,000		
6	2000 David Court	$550,000		
7	892 Miller Lane	$385,500		
8		$1,990,500		
9				
10				
11	1045 David Court	$430,000		
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				

FIGURE 3-13: The Paste Option button's palette with the option buttons that commonly appear after pasting a cell selection that's been copied to the Clipboard. (Sample workbook: Home Sales.xlsx)

- **Keep Source Formatting (K):** Excel copies the formatting from the original cells and pastes this into the destination cells (along with the copied entries).
- **No Borders (B):** Excel pastes everything in the cell selection without copying any borders applied to its cell range.
- **Keep Source Column Widths (W):** Excel makes the width of the columns in the destination range the same as those in the source range when it copies their cell entries.
- **Transpose (T):** Excel changes the orientation of the pasted entries. For example, if the original cell entries run down the rows of a single column of the worksheet, the transposed pasted entries run across the columns of a single row.
- **Merge Conditional Formatting (G):** Excel combines the conditional formatting rules of the source and destination ranges. You don't see this button if neither range has any conditional

formatting rules applied. See Book 2, Chapter 2 to find out more about conditional formatting.

The three buttons that appear in the Paste Values section of the Paste Options palette are

- **Values (V):** Excel pastes only the calculated results of any formulas in the source cell range.
- **Values & Number Formatting (A):** Excel pastes the calculated results of any formulas along with all the formatting assigned to the values in the source cell range into the destination range.
- **Values & Source Formatting (E):** Excel pastes the calculated results of all formulas along with all formatting assigned to the source cell range.

The four buttons that appear in the Other Paste Options section of the Paste Options palette are

- **Formatting (R):** Excel pastes only the formatting (and not the entries) copied from the source cell range to the destination range.
- **Paste Link (N):** Excel creates linking formulas in the destination range so that any changes that you make to the entries in cells in the source range are also reflected in the corresponding cells of the destination range.
- **Picture (U):** Excel pastes only the pictures in the copied cell selection.
- **Linked Picture (I):** Excel pastes a link to the pictures in the copied cell selection.

Taking it out of the Clipboard task pane

When the Office Clipboard is open, Excel puts the contents of all cell selections that you copy and paste (using the Copy and Paste command buttons or their keyboard equivalents) into the Office Clipboard. In fact, the Office Clipboard stores the contents of up to the last 24 copied-and-pasted cell selections (before replacing them with new copied-and-pasted selections) not only from Excel, but from every Office program. Up to that point, you can examine the contents of the Office Clipboard and even paste your cell selections in other places in your worksheet or in documents open in other programs that you’re running.

To open the Clipboard task pane on the left side of the Excel program window, click the dialog box launcher in the lower-right corner of the

Home tab's Clipboard group.

When the Clipboard task pane is displayed, it shows all the individual cut or copied items that have been placed there (up to a maximum of 24). While this pane is open, Excel also places there all selections that you cut or copy in the worksheet, even those that you paste by pressing the Enter key as well as those you don’t paste elsewhere.

REMEMBER If you want Excel to place all selections that you cut and copy in the worksheet into the Office Clipboard even when the Clipboard task pane is not open, click Options at the bottom of the Clipboard pane and then click to activate the Collect Without Showing Office Clipboard option.

To paste an item on the Clipboard into a cell of one of your worksheets, click the cell and then click the item in the Clipboard task pane.

TIP If you’re doing a lot of copy-or-cut-and-paste work in a worksheet using the Clipboard, you can have Excel automatically display the Clipboard task pane as you do the editing. Open the Clipboard task pane, click the Options button at the very bottom, and then click to activate the Show Office Clipboard Automatically option. When this setting is selected, Excel automatically opens the Clipboard task pane if you put more than two items in the Clipboard during your work session. To have Excel display the Clipboard task pane when you press Ctrl + C twice in a row (Ctrl + CC), click to activate the Show Clipboard When Ctrl + C Pressed Twice option from the Options menu.

Inserting rather than replacing copied cells

When you use cut-or-copy-and-paste to move or copy a cell selection, you can have Excel paste the data into the worksheet without replacing existing entries in overlaid cells. In the Home tab's Cells group, click Insert and then click either Insert Cut Cells or Insert Copied Cells (depending on whether you cut or copied the cells to the Clipboard) instead of clicking the normal Paste command. Excel displays the Insert dialog box, where you can choose between the following options:

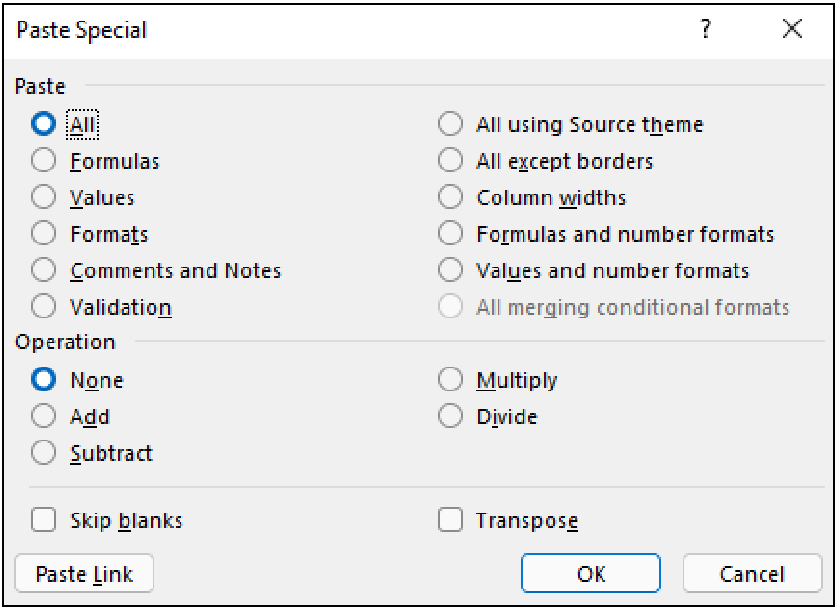
- **Shift Cells Right:** Excel moves the existing cells to the right to make room for the moved or copied cells.
- **Shift Cells Down:** Excel moves the existing cells down to make room for the moved or copied cells.

TIP If you want to shift existing cells down to make room for the ones you’ve cut or copied to the Clipboard, you can click the Home tab's Insert button rather than dropping down its menu.

Pasting just the good parts with Paste Special

Normally, when you paste worksheet data from the Clipboard, Excel pastes all the information (entries, formatting, and comments) from the cell selection into the designated paste area, thus replacing any existing entries in the cells that are overlaid. However, the Home tab's Paste button also has a drop-down menu that you can use to choose how you want Excel to paste your data. You can also click Paste Special from this drop-down menu (or press Alt+HVS) to open the Paste Special dialog box for extra pasting goodness.

The Paste Special dialog box (see Figure 3-14) offers a wide range of pasting options, including some that perform simple mathematical computations (Add, Subtract, Multiply, and Divide) between the number of cell entries that overlay each other. (See Table 3-1.)



Paste Special

Paste

- ● All
- ○ Formulas
- ○ Values
- ○ Formats
- ○ Comments and Notes
- ○ Validation
- ○ All using Source theme
- ○ All except borders
- ○ Column widths
- ○ Formulas and number formats
- ○ Values and number formats
- ○ All merging conditional formats

Operation

- ● None
- ○ Add
- ○ Subtract
- ○ Multiply
- ○ Divide

☐ Skip blanks ☐ Transpose

FIGURE 3-14: The paste options in the Paste Special dialog box give you control over how a cell selection on the Clipboard is pasted into your worksheet.

TABLE 3-1 The Paste Special Dialog Box Options

Option	*What It Does*
All	Pastes all types of entries (numbers, formulas, and text), their formats, and comments from the selection in the paste area
Formulas	Pastes only the entries (numbers, formulas, and text) from the selection in the paste area
Values	Pastes only numbers and text from the selection in the paste area, converting all formulas to their current calculated values so they're pasted into the worksheet as numbers
Formats	Pastes only the formats from the selection into the paste area
Comments and Notes	Pastes only the comments and notes from the selection into the paste area
Validation	Pastes only the data validation settings from the selection into the paste area (see Book 2, Chapter 1 for info on data validation)
All Using Source Theme	Pastes all types of entries (numbers, formulas, and text), their formats, comments, and notes from the selection in the paste area and uses the colors, fonts, and graphic effects in the theme assigned to their source worksheet (see Book 5, Chapter 2)
All Except Borders	Pastes everything but the borders assigned to the cell selection into the paste area
Column Widths	Pastes everything into the paste area and adjusts the column widths in this area to match those of the original cell selection
Formulas and Number Formats	Pastes the labels, values, and formulas from the cell selection into the paste area, but only pastes the formatting of the numeric entries
Values and Number Formats	Pastes the labels, values, and formula results from the cell selection into the paste area, but only pastes the formatting of the numeric entries
All Merging Conditional Formats	Pastes only the numbers and number formatting that meets the conditions specified by conditional formatting in the cell selection (see Book 2, Chapter 2)
None	Performs no mathematical operation between the values in the cell selection placed on the Clipboard and those in the destination range in the worksheet (the default)

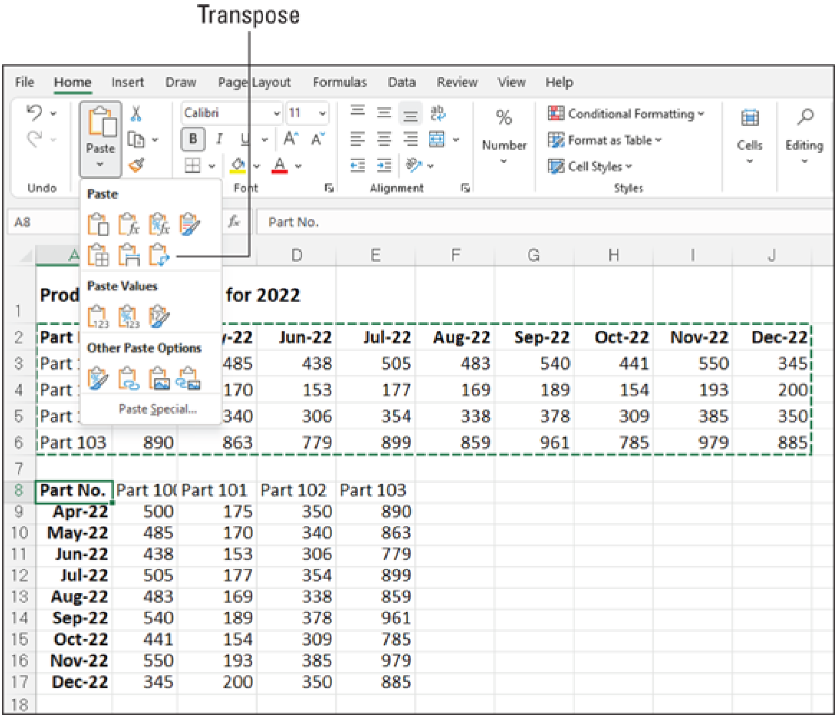
Add	Adds the values in the cell selection placed on the Clipboard to those in the destination range in the worksheet
Subtract	Subtracts the values in the cell selection placed on the Clipboard from those in the destination range in the worksheet
Multiply	Multiplies the values in the cell selection placed on the Clipboard with those in the destination range in the worksheet
Divide	Divides the values in the cell selection placed on the Clipboard by those in the destination range in the worksheet
Skip Blanks	When selected, doesn't replace existing entries in the worksheet with any overlaying blank cells placed on the Clipboard as part of the cut or copied cell selection
Transpose	When selected, switches the orientation of the entries in the cell selection placed on the Clipboard so that data that originally ran across the rows now runs down the columns in the new area of the worksheet and the data that ran down columns now runs across rows
Paste Link	Pastes links to the original cell selection placed on the Clipboard

The options in the Paste Special dialog box are divided into two areas: Paste and Operation. The Paste option buttons (some of which duplicate the options on the drop-down menu on the Ribbon and the Paste Option’s palette in the worksheet) enable you to specify which components of the copied cell selection you want copied; see Table 3-1 for a list of options.

The Operation option buttons in the Paste Special dialog box enable you to specify which mathematical operation, if any, should be performed between the overlaying values in copy and paste ranges. Select the Skip Blanks check box when you don’t want Excel to replace existing entries in the paste range with overlaying blank cells in the copy range.

The Transpose option, which appears on the Paste button’s drop-down menu and the Paste Options button (also duplicated by the Transpose check box in the Paste Special dialog box), is particularly helpful when you have a row of column headings that you want to convert into a column of row headings or when you have a column of row headings that you want to convert into a row of column headings. You can also use this option to pivot an entire table of data so that the data that runs across the rows now runs down the columns, and vice versa.

Figure 3-15 (sample workbook: Production Schedule - 2022.xlsx) illustrates just such a situation. Here, I selected the production schedule table (including the column headings) in the cell range A2:J6, clicked the Home tab's Copy button, and then moved the cell cursor to cell A8. After that, I chose the Transpose option from the Paste button’s drop-down menu. Excel’s Live Preview feature then shows how this transposition would appear in the cell range A8:E17 in Figure 3-15.



Transpose
File
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Help
Undo
Paste
Calibri
11
Font
Alignment
Number
Conditional Formatting
Format as Table
Cell Styles
Styles
Cells
Editing
Paste
Paste Values
Other Paste Options
Paste Special...

A8 | Part No.

	A	B	C	D	E	F	G	H	I	J
1	Prod		for 2022							
2	Part		y-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22
3	Part		485	438	505	483	540	441	550	345
4	Part		170	153	177	169	189	154	193	200
5	Part		340	306	354	338	378	309	385	350
6	Part 103	890	863	779	899	859	961	785	979	885
7										
8	Part No.	Part 10(	Part 101	Part 102	Part 103					
9	Apr-22	500	175	350	890					
10	May-22	485	170	340	863					
11	Jun-22	438	153	306	779					
12	Jul-22	505	177	354	899					
13	Aug-22	483	169	338	859					
14	Sep-22	540	189	378	961					
15	Oct-22	441	154	309	785					
16	Nov-22	550	193	385	979					
17	Dec-22	345	200	350	885					
18										

FIGURE 3-15: Transposing a copy of the production schedule table so that dates now form the row headings and the part numbers now form the column headings. (Sample workbook: Production Schedule - 2022.xlsx)

In the transposed table, the original row headings are now the column headings just as the original column headings are now the row headings. Note, too, that when transposing the table, Excel retains any formulas from the original range and adjusts the cell and range operands as needed to preserve the results.

TIP

To convert a cell range that contains formulas to its calculated values (as though you had input them as numbers), select the cell range, click the Home tab's Copy button, and then click the Paste Values option from the Paste button's drop-down menu *without* moving the cell cursor. This causes Excel to paste the calculated values on top of the formulas that created them, thus zapping the overlaid formulas and leaving you with only the computed values!

Finding and Replacing Worksheet Data

No discussion of worksheet editing would be complete without including the Find and Replace features in Excel. You can use the Find feature to quickly locate one or more occurrences of a specified *string* (a series of characters) or numeric value in a worksheet. You can use the Replace feature to have Excel update the cells that it finds with new text or numbers.

Both the Find and the Replace features share the same dialog box — aptly called the Find and Replace dialog box. If you only want to find a cell's particular contents, you use the options on the Find tab. If you want to update the contents of some or all of the cells that you find, use the options on the Replace tab.

The Find and Replace tabs in the Find and Replace dialog box contain a bunch of search options that you can use in finding and replacing stuff in your worksheet. The only problem is that these options are hidden when you first open the Find and Replace dialog box. To expand the Find and Replace dialog box to display the extra search options on the Find and Replace tab, click the Options button.

Finding data

To use the Find command to locate information in your worksheet, follow these steps:

1. **To search the entire worksheet, select a single cell. To restrict the search to a specific cell range or nonadjacent selection, select all the cells you want to search.**
2. **In the Home tab's Editing group, click Find & Select (the magnifying glass icon) and then click Find (or press either Ctrl+F or Alt+HFDF).**

   Excel opens the Find and Replace dialog box with the Find tab selected.
3. **Type the search value that you want to locate in the Find What combo box.**

   When entering the search value, you can use the question mark (?) or asterisk (*) wildcards to stand in for any characters that you're unsure of. Use the question mark to stand for a single character, as in *Sm?th,* which matches either *Smith* or *Smyth*. Use the asterisk to stand for multiple characters as in *9*1,* which locates *91, 94901,* or even *9553 1st Street*. To search with the asterisk as a literal character, precede the character with a tilde (~), as in ~*2.5,* to locate formulas that are multiplied by the number 2.5. (The asterisk is the multiplication operator in Excel.)

If the cell holding the search string that you're looking for is formatted in a particular way, you can narrow the search by specifying what formatting to search for.

4. **Click the Format drop-down button and then either click the Format command to select the formatting from the Find Format dialog box or click the Choose Format from Cell command to select the formatting directly from a cell in the worksheet. (If you don't see the Format button, click Options to display it.)**

   When you click the Format command, Excel opens the Find Format dialog box with the same tabs and options as the standard Format Cells dialog box (Number, Alignment, Font, Border, Fill, and Protection). You then select the formatting that you want to search for in this dialog box and click OK.

   When you click the Choose Format from Cell command, the Find and Replace dialog box temporarily disappears until you click the cell in the worksheet that contains the formatting that you want to search for with the thick, white-cross mouse pointer with eyedropper icon.

   Note that when using the Find feature to locate a search string, by default, Excel searches only the current worksheet for your search string. If you want

Excel to search all the cells of all worksheets in the workbook, you need to follow Step 5.

5. **In the Within list, choose the Workbook option to have Excel search all worksheets in the workbook.**

   If the Within drop-down list box doesn't appear at the bottom of your Find and Replace dialog box, click the Options button to expand it and add the Within, Search, and Look In drop-down lists along with the Match Case and Match Entire Cell Contents check boxes.

6. **Choose the By Columns option from the Search drop-down menu to have Excel search down the columns (that is, down and then to the right from the active cell).**

   By default, Excel locates the search string in the contents of each cell as entered on the Formula bar. This means that if you're looking for a cell that contains 1,250 and the worksheet contains the formula =750+500, whose calculated value as displayed in the cell is 1,250, Excel won't consider this cell to be a match because in searching the Formula bar, it finds =750+500 instead of 1,250.

7. **Choose Values from the Look In drop-down menu to have Excel locate the search string in the contents of each cell as it's displayed in the worksheet. Choose Comments from this drop-down menu instead to have Excel locate the search string in the comments that you've added to cells.**

   Note that when you select Comments to search the comments you've added to the worksheet, you can't specify any formatting to search for because the Format button in the Find and Replace dialog box becomes grayed out.

8. **Select the Match Case check box to find occurrences of the search string when it matches the case that you entered.**

   By default, Excel ignores case differences between the search string and the content of the cells being searched so that *Assets, ASSETS,* and *assets* all match the search string, *Assets.*

9. **Select the Match Entire Cell Contents check box to find occurrences of the search string only when it's the entire cell entry.**

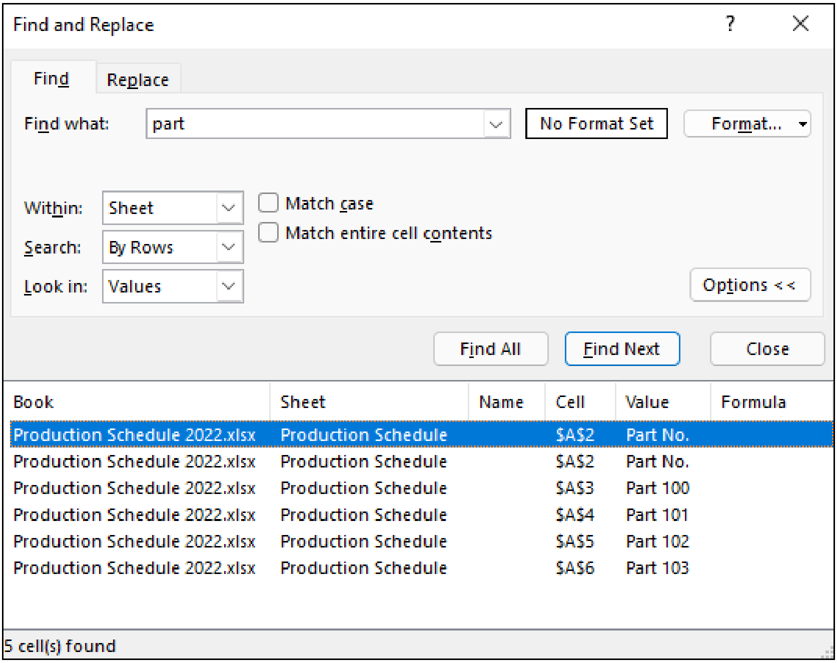
   By default, Excel considers any occurrence of the search string to be a match — even when it occurs as part of another cell entry. So when the search string is 25, cells containing 25, 15.25, 25 Main Street, and 250,000 are all considered matches.

10. **Click the Find All button to find all occurrences of the search string. Click the Find Next button to find just the first occurrence of the search string.**

    When you click Find All, Excel lists all the cells containing the search string in a list box at the bottom of the Find and Replace dialog box, as shown in Figure 3-16. You can then have Excel select the cell with a particular occurrence by clicking its link in this list box. You may have to drag the Find and Replace dialog box out of the way to see the selected cell.

    When you click Find Next, Excel selects the next cell in the worksheet (using the designated search direction). To find subsequent occurrences of the search string, you need to continue to click Find Next until you reach the cell that you're looking for. Again, you may have to drag the Find and Replace dialog box out of the way to see the cell that Excel has located and selected in the worksheet.

11. **After you finish searching the worksheet for the search string, click the Close button.**



Find what: part

Within: Sheet

Search: By Rows

Look in: Values

☐ Match case

☐ Match entire cell contents

Book	Sheet	Name	Cell	Value	Formula
Production Schedule 2022.xlsx	Production Schedule		$A$2	Part No.	
Production Schedule 2022.xlsx	Production Schedule		$A$2	Part No.	
Production Schedule 2022.xlsx	Production Schedule		$A$3	Part 100	
Production Schedule 2022.xlsx	Production Schedule		$A$4	Part 101	
Production Schedule 2022.xlsx	Production Schedule		$A$5	Part 102	
Production Schedule 2022.xlsx	Production Schedule		$A$6	Part 103	

5 cell(s) found

FIGURE 3-16: Finding a value in a worksheet by using the options on the Find tab.

Note that Excel retains your search string and search option conditions even after closing the Find and Replace dialog box. To repeat a search, just press Ctrl+F and then click Find All or Find Next. You can also reinstate a search string that you used earlier in your work session by choosing it from the Find What drop-down menu.

Finding and replacing data

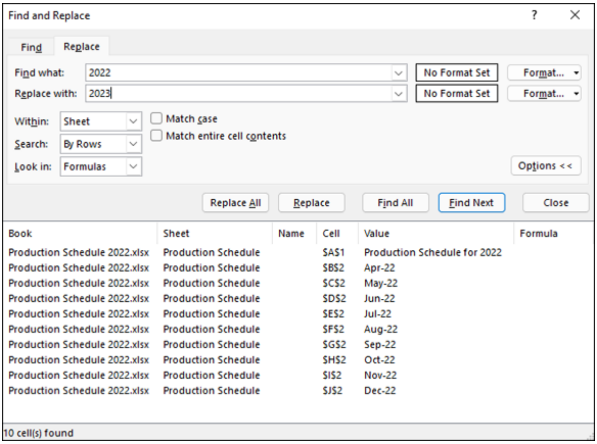
The Find feature is sufficient if all you want to do is locate an occurrence of a search string in your worksheet. Many times, however, you also want to change some or all of the cells that match the search string. For those situations, you use the Replace feature to locate the search string and replace it with some other string.

To search and replace information in your worksheet, follow these steps:

1. **To search and replace the entire worksheet, select a single cell. To restrict the search and replace operation to a specific cell, range, or nonadjacent selection, select all the cells to be searched.**

2. **In the Home tab's Editing group, click Find & Select (the magnifying glass icon) and then click Replace (or press either Ctrl + H or Alt + HFDR).**

   Excel opens the Find and Replace dialog box with the Replace tab selected (similar to the one shown in Figure 3-17). Note that if the Find and Replace dialog box is already open from choosing the Find option from the Find & Select button's drop-down menu or pressing Ctrl + F, all you have to do is click the Replace tab.



Find what: 2022

Replace with: 2023

Within: Sheet

Search: By Rows

Look in: Formulas

☐ Match case

☐ Match entire cell contents

Book	Sheet	Name	Cell	Value	Formula
Production Schedule 2022.xlsx	Production Schedule		$A$1	Production Schedule for 2022	
Production Schedule 2022.xlsx	Production Schedule		$B$2	Apr-22	
Production Schedule 2022.xlsx	Production Schedule		$C$2	May-22	
Production Schedule 2022.xlsx	Production Schedule		$D$2	Jun-22	
Production Schedule 2022.xlsx	Production Schedule		$E$2	Jul-22	
Production Schedule 2022.xlsx	Production Schedule		$F$2	Aug-22	
Production Schedule 2022.xlsx	Production Schedule		$G$2	Sep-22	
Production Schedule 2022.xlsx	Production Schedule		$H$2	Oct-22	
Production Schedule 2022.xlsx	Production Schedule		$I$2	Nov-22	
Production Schedule 2022.xlsx	Production Schedule		$J$2	Dec-22	

10 cell(s) found

FIGURE 3-17: Updating dates in a worksheet using the Find and Replace feature.

3. **In the Find What combo box, type the search string that you want to locate and specify any formatting to be searched by using its Format button.**

   Refer to the previous steps on finding a search string for details on specifying the search string in the Find What combo box and specifying the formatting to be searched for.

4. **In the Replace With combo box, type the replacement string.**

   Enter this string *exactly* as you want it to appear in the cells of the worksheet. Use uppercase letters where uppercase is to appear, lowercase letters where lowercase is to appear, and the question mark and asterisk only where they are to appear. (They don’t act as wildcard characters in a replacement string.)

5. **Click the Format drop-down button and click Format to select the formatting to be added to your replacement string from the Find Format dialog box. Or click Choose Format from Cell and select the formatting directly from a cell in the worksheet.**

   When you click the Format item, Excel opens a Find Format dialog box with the same tabs and options as the standard Format Cells dialog box. You may then select the formatting that you want the replacement string to have in this dialog box and then click OK.

   When you click the Choose Format from Cell item on the Format button drop-down menu, the Find and Replace dialog box temporarily disappears until you click the cell in the worksheet that contains the formatting that you want the replacement string to have with the thick, white-cross mouse pointer with eyedropper icon.

   REMEMBER You're free to run formatting-only search-and-replace operations. For example, you may want to replace all instances of bold with italics. In this case, you don't specify a string either in the Find

What text box or the Replace With text box.

6. **Make any necessary changes to the Within, Search, Look In, Match Case, and Match Entire Cell Contents options for the search string.**

   These options work just as they do on the Find tab. If these options aren't displayed on the Replace tab of your Find and Replace dialog box, click its Options button to expand the dialog box.

7. **Click the Find Next button to locate the first occurrence of the search string. Then, click the Replace button to replace the first occurrence with the replacement string or click the Find Next button again to skip this occurrence.**

   Using the Find Next and Replace buttons to search and replace on a case-by-case basis is by far the safest way to use the Find and Replace feature. If you're certain (really certain) that you won't mess up anything by replacing all occurrences throughout the worksheet, you can click the Replace All button to have Excel make the replacements globally without stopping to show you which cells are updated.

8. **When you finish replacing entries on a case-by-case basis, click the Close button.**

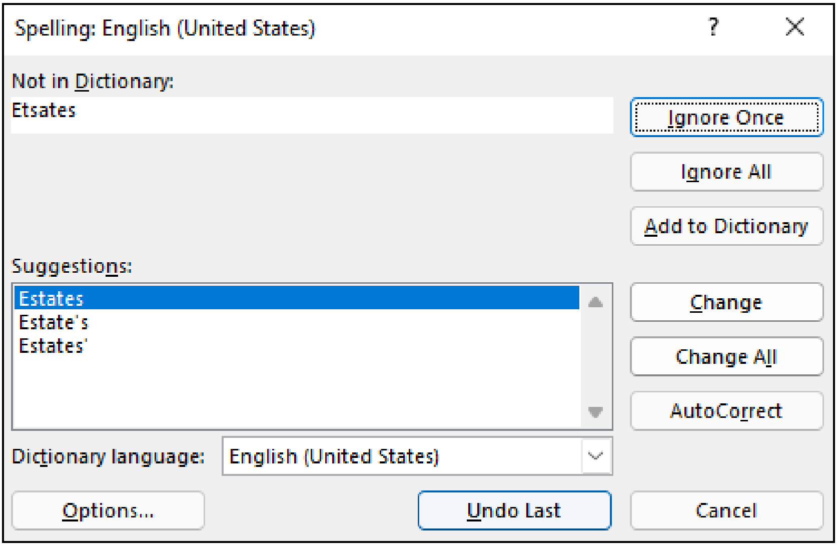
   This action abandons the Find and Replace operation and closes the Find and Replace dialog box. When you globally replace the search string, Excel automatically closes the Find and Replace dialog box after replacing the last search string match.

REMEMBER You can click the Undo button on the Quick Access toolbar or press Ctrl + Z to restore any replacements that you made in error.

Getting It Right: Spell Checking Your Worksheets

You can use Excel's Spell Check feature to catch all the spelling mistakes that AutoCorrect lets slip through. To spell check your worksheet, display the Review tab and click the Spelling button (it's in the Proofing group) or press either F7 or Alt+RS.

When you spell check a worksheet, Excel looks up each word in the Excel Dictionary. If the word isn't found (as is often the case with less-common last names, abbreviations, acronyms, and technical terms), Excel selects the cell with the unknown spelling and then displays a Spelling dialog box showing the unknown word in the Not in Dictionary text box with suggested correct spellings shown in a Suggestions list box below, which is similar to the one shown in Figure 3-18.



Spelling: English (United States)

Not in Dictionary: Etsates

Suggestions:
Estates
Estate's
Estates'

Dictionary language: English (United States)

FIGURE 3-18: Spell checking a worksheet with the Spelling dialog box.

You can then take any of the following actions to take care of the unknown word:

- Click one of the words in the Suggestions list box and then click the Change button to have Excel replace the unknown word with the selected suggestion and continue spell checking the rest of the worksheet.

- Click one of the words in the Suggestions list box and then click the Change All button to have Excel replace all occurrences of the unknown word with the selected suggestion throughout the entire worksheet and then continue spell checking.
- Click the Ignore Once button to let the misspelling slide just this once and continue spell checking the rest of the worksheet.
- Click the Ignore All button to ignore all occurrences of the unknown word in the worksheet and continue spell checking.
- Click the Add to Dictionary button to add the unknown word to a custom dictionary so that Excel knows the word the next time you spell check the worksheet.
- Click the AutoCorrect button to have Excel add the unknown word to the AutoCorrect list with the selected suggestion as its automatic replacement.

REMEMBER Excel checks the spelling of the cells only in the current worksheet (and not all the sheets in the workbook). If you want Excel to spell check another worksheet, you need to click its sheet tab to make it active and then click the Spelling button on the Review tab (or press F7). If you want to spell check just a portion of the worksheet, select the range or nonadjacent cell selection before you start the spell check.

When Excel finishes checking the current worksheet or cell selection, the program displays an alert dialog box that indicates that the spell checking has been completed.

Changing the spelling options

When you use the Spell Check feature, you can change certain spelling options to better suit the worksheet that you’re checking. To change the spelling options, you have two choices:

- If the Spelling dialog box is onscreen (meaning Excel has found what it thinks is a spelling error), click the Options button.
- Choose File ⇒ Options ⇒ Proofing.

The Proofing tab of the Excel Options dialog box opens with the following options in the When Correcting Spelling in Microsoft Office Programs section:

- **Ignore Words in UPPERCASE:** Remove the check mark from the check box so that Excel marks acronyms and other words entered in all uppercase letters as misspellings.
- **Ignore Words That Contain Numbers:** Remove the check mark from the check box so that Excel marks words such as B52 that contain letters and numbers as misspellings.
- **Ignore Internet and File Addresses:** Remove the check mark from the check box so that Excel marks web URL addresses such as `www.dummies.com` and file pathnames such as `c:\documents\finance` as misspellings.
- **Flag Repeated Words:** Remove the check mark so that Excel no longer marks repeated words such as Bora Bora as misspellings.
- **Enforce Accented Uppercase in French:** Add a check mark so that Excel marks uppercase French words that don't have the proper accent marks as misspellings.
- **Suggest from Main Dictionary Only:** Have Excel use only the main dictionary when doing a spell check (thus, ignoring all words that you've added to a custom dictionary).
- **Custom Dictionaries:** Open the Custom Dictionaries dialog box where you can edit the words in a custom dictionary or add a new custom dictionary to be used in spell checking. (See "Adding words to the custom dictionary" that follows.)
- **French Modes or Spanish Modes:** Choose between the traditional or more modern spellings of French or Spanish words, respectively.
- **Dictionary Language:** Specify the language and country of the dictionary to use when spell checking the worksheet.

Adding words to the custom dictionary

You use the Add to Dictionary button in the Spelling dialog box to add unknown words to a custom dictionary. By default, Excel adds words to a custom dictionary file named `RoamingCustom.dic`. To locate this file on your device, search for **roamingcustom.dic** in the Windows File Explorer.

If you want, you can create other custom dictionaries to use when spell checking your worksheets. To create a new custom dictionary, follow these steps:

1. **If the Spelling dialog box is onscreen, click Options. Otherwise, choose File ⇒ Options ⇒ Proofing.**

   Excel opens the Excel Options dialog box with the Proofing tab displayed.

2. **Click Custom Dictionaries.**

   Excel opens the Custom Dictionaries dialog box.

3. **Click New.**

   Excel opens the Create Custom Dictionary dialog box.

4. **Type the name for your new custom dictionary and then click Save.**

   After the Create Custom Dictionary dialog box closes, the name of the custom dictionary you created appears underneath RoamingCustom.dic (Default) in the Dictionaries list box.

5. **(Optional) To restrict the language of a custom dictionary, use the Dictionaries list to select the custom dictionary and then use the Dictionary Language drop-down list to select the language you want to use.**

6. **To make the new custom dictionary the default dictionary into which new words are saved, click the dictionary's name in the Dictionaries list and then click Change Default.**

7. **Click OK to close the Custom Dictionaries dialog box and then click OK again to close the Excel Options dialog box.**

   Excel returns you to the Spelling dialog box.

8. **Click the Add to Dictionary button to add the unknown word to the new default custom dictionary and then continue spell checking your worksheet.**

Note that Excel continues to add all unknown words to your new custom dictionary until you change the default back to the original custom dictionary (or to another custom one that you've created). To change back and start adding unknown words to the original custom dictionary, select the `RoamingCustom.dic` file in the Custom Dictionaries dialog box and then click the Change Default button.

TIP

You can directly edit the words that you add to your custom dictionary. Click the Custom Dictionaries button on the Proofing tab of the Excel Options dialog box (File ⇒ Options ⇒ Proofing or Alt + FTP), select the dictionary in the Dictionaries list, and then click the Edit Word List command button. Excel then opens a dialog box with the default dictionary's name that contains a Word(s) text box where you can enter new words to add to the custom dictionary and a Dictionary list box below that lists all the words added to the dictionary in alphabetical order. To add a new word to the dictionary, type it in the Word(s) text box (carefully, you don't want to add a misspelling to the dictionary) and then click the Add button. To remove a word, click it in the Dictionary list box and then click the Delete button.

Looking Up and Translating Stuff

Besides the very useful Spelling button (discussed in the previous section), the Proofing, Insights, and Language groups on the Review tab contains three other command buttons that can come in handy from time to time:

- **Thesaurus** opens the Thesaurus task pane. Here you can look up synonyms for a particular term that you enter into the Search For text box or for the contents of the current cell automatically entered into this text box.
- **Smart Lookup** opens the Search task pane where you can find a definition and more online information about the entry that's in the active cell when you click it.
- **Translate** opens the Translator task pane. Here you can look up a translation for a particular term that you enter into the text box under the From drop-down button. You then select the target language using the To drop-down button's list.

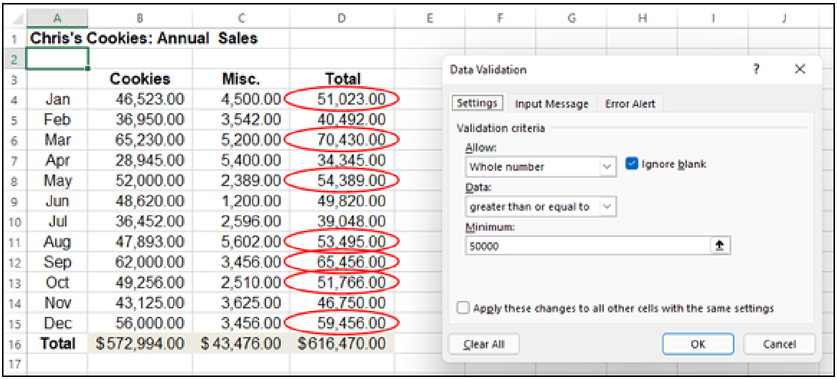
Marking Invalid Data

Besides using the Data Validation feature to restrict what kind of data can be entered into cell ranges of a worksheet as described in Book 2, Chapter 1, you can also use Data Validation to mark all the data (by circling their cells) that are outside of expected or allowable parameters.

To use the Data Validation feature in this way, you follow these general steps:

1. **Select the cell range(s) in the worksheet that need to be validated and marked.**
2. **In the Data tab's Data Tools group, click Data Validation (or press Alt+AVV) to open the Data Validation dialog box.**
3. **Use the Data Validation dialog box options to set up the validation criteria that determine which values in the selected cell range are out of bounds. (See Book 2, Chapter 1 for details.)**
4. **In the Data tab's Data Tools group, choose Data Validation ⇒ Circle Invalid Data (or press Alt+AVI).**

Figure 3-19 (sample worksheet: Chris's Cookies - Annual Sales.xlsx) shows an example of how you may use Data Validation to mark entries that are below a certain threshold. In this case, I set up Data Validation to check the monthly sales in the Total column (the range D4:D15) and treat as valid any values that are above $50,000. Values below that threshold get marked with a red circle around their cells.



	A	B	C	D
1	Chris's Cookies: Annual Sales			
2				
3		Cookies	Misc.	Total
4	Jan	46,523.00	4,500.00	51,023.00
5	Feb	36,950.00	3,542.00	40,492.00
6	Mar	65,230.00	5,200.00	70,430.00
7	Apr	28,945.00	5,400.00	34,345.00
8	May	52,000.00	2,389.00	54,389.00
9	Jun	48,620.00	1,200.00	49,820.00
10	Jul	36,452.00	2,596.00	39,048.00
11	Aug	47,893.00	5,602.00	53,495.00
12	Sep	62,000.00	3,456.00	65,456.00
13	Oct	49,256.00	2,510.00	51,766.00
14	Nov	43,125.00	3,625.00	46,750.00
15	Dec	56,000.00	3,456.00	59,456.00
16	Total	$572,994.00	$ 43,476.00	$616,470.00
17				

Data Validation

Validation criteria

Allow: Whole number

☑ Ignore blank

Data: greater than or equal to

Minimum: 50000

☐ Apply these changes to all other cells with the same settings

FIGURE 3-19: Using Data Validation to mark entries below a specified threshold ($50,000 in this

case) in a table. (Sample worksheet: Chris's Cookies - Annual Sales.xlsx)

REMEMBER To remove the circles from the cells marked as invalid, choose the Clear Validation Circles option from the Data Validation button’s drop-down menu or press Alt + AVR. To clear the validation settings from the cells, select the range and then open the Data Validation dialog box and click its Clear All button before you click OK.

Chapter 4

Managing Worksheets

IN THIS CHAPTER

- **Inserting and deleting columns and rows in a worksheet**
- **Splitting the worksheet into separate panes**
- **Outlining data in a worksheet**
- **Inserting, deleting, and reordering worksheets in a workbook**
- **Opening windows on different worksheets in a workbook**
- **Working with multiple workbooks**
- **Opening windows on different workbooks**
- **Consolidating worksheet data**

Being able to manage and reorganize the information in your worksheets is almost as important as being able to input data and edit it. As part of these skills, you need to know how to manipulate the columns and rows of a single worksheet, the worksheets within a single workbook, and, at times, other workbooks that contain supporting or relevant data.

This chapter examines how to reorganize information in a single worksheet by inserting and deleting columns and rows, as well as how to apply outlining to data tables that enables you to expand and collapse details by showing and hiding columns and rows. It also covers how to reorganize and manipulate the worksheets in a workbook and discusses strategies for visually comparing and transferring data between the different workbooks that you have open for editing.

Reorganizing the Worksheet

Every Excel worksheet that you work with has 16,384 columns and 1,048,576 rows — no more, no less, regardless of how many or how few of its cells you use. As your worksheet grows, you may find it beneficial to rearrange the data so that it doesn't creep. Many times, this involves deleting unnecessary columns and rows to bring the data ranges and tables closer to each other. At other times, you may need to insert new columns and rows in the worksheet to create some breathing room between the groups of data.

Within the confines of this humongous worksheet space, your main challenge is often keeping tabs on all the information spread out throughout the sheet. At times, you may find that you need to split the worksheet window into panes so that you can view two disparate regions of the worksheet together in the same window and compare their data. For large ranges and tables, you may want to outline the worksheet data so that you can immediately collapse the information down to the summary or essential data and then just as quickly expand the information to show some or all of the supporting data.

Being cautious when deleting and inserting columns and rows

The first thing to keep in mind when inserting or deleting columns and rows in a worksheet is that these operations affect all 1,048,576 rows in those columns and all 16,384 columns in those rows. As a result, you have to be sure that you're not about to adversely affect data in unseen rows and columns of the sheet before you undertake these operations. Note that, in this regard, inserting columns or rows can be almost as detrimental as deleting them if, by inserting them, you split apart existing data tables or lists whose data should always remain together.

One way to guard against inadvertently deleting existing data or splitting apart a single range is to use the Zoom slider on the Status bar to zoom out on the sheet and then check visually for intersecting groups of data in the hinterlands of the worksheet. You can do this quickly by dragging the Zoom slider button to the left to the 25% setting. Of course, even at the smallest zoom setting of 10%, you can see neither all the columns nor all the rows in the worksheet, and because everything's so tiny at that setting, you can't always tell whether the column or row you intend to fiddle with intersects those data ranges that you can identify.

Another way to check is to press End+→ or End+↓ to move the cell pointer from data range to data range across the column or row affected by your column or row deletion. Remember that pressing End plus an arrow key when the cell pointer is in a blank cell jumps the cell pointer to the next occupied cell in its row or column. That means if you press End+→ when the cell pointer is in row 52 and the pointer jumps to cell XFD52 (the end of the worksheet in that row), you know that there isn't any data in that row that would be eliminated by your deleting that row or shifted up or down by your inserting a new row. So too, if you press End+↓ when the cell pointer is in column D and the cell pointer jumps down to cell D1048576, you're assured that no data is about to be purged or shifted left or right by that column's deletion or a new column's insertion at that point.

When you're sure that you aren't about to make any problems for yourself in other, unseen parts of the worksheet by deleting or inserting columns, you're ready to make these structural changes to the worksheet.

Deleting columns and rows

To delete columns or rows of the worksheet, select them by clicking their column letters or row numbers in the column or row header and then, in the Home tab's Cells group, click the Delete button. (Alternatively, click any selected column or row header and then click Delete.) Remember that you can select groups of columns and rows by dragging through their letters and numbers in the column or row header. You can also select nonadjacent columns and rows by holding down the Ctrl key as you click them.

When you delete a column, all the data entries within the cells of that column are immediately zapped. At the same time, all remaining data entries in succeeding columns to the right move left to fill the blank left by the now-missing column. When you delete a row, all the data entries within the cells of that row are immediately eliminated, and the remaining data entries in rows below move up to fill in the gap left by the missing row.

TIP Rather than selecting the columns or rows you want to delete in advance, you can also select just one or more cells in each column or row. Then, in the Home tab's Cells group, click the Delete button's drop-down list and then click either Delete Sheet Columns or Delete Sheet Rows.

REMEMBER Pressing the Delete key is *not* the same as clicking the Delete button on the Home tab of the Ribbon. When you press the Delete key after selecting columns or rows in the worksheet, Excel clears the data entries in their cells without adjusting any of the existing data entries in neighboring columns and rows. Click the Delete command button on the Home tab when your purpose is *both* to delete the data in the selected columns or rows *and* to fill in the gap by adjusting the position of entries to the right and below the ones you eliminate.

WARNING Should your row or column deletions remove data entries referenced in formulas, the #REF! error value replaces the calculated values in the cells of the formulas affected by the elimination of the original cell references. You must then either restore the deleted rows or columns or re-create the original formula and then recopy it to get rid of these nasty formula errors. (See Book 3, Chapter 2 for more on error values in formulas.)

Adding new columns and rows

To insert a new column or row into the worksheet, you select the column or row where you want the new blank column or row to appear (again by clicking its column letter or row number in the column or row header):

- For a new column, select the column to the left of which you want the new column to appear.
- For a new row, select the row above which you want the new column to appear.

Then, in the Home tab's Cells group, click the Insert button. (Alternatively, click any selected column or row header and then click Insert.)

When you insert a blank column, Excel moves the existing data in the selected column to the right, while simultaneously moving any other columns of data on the right over one. When you insert a blank row, Excel moves the existing data in the selected row down, while simultaneously adjusting any other rows of existing data that fall below it down by one.

To insert multiple columns or rows at one time in the worksheet, select the columns or rows where you want the new blank columns or rows to appear (by dragging through their column letters and row numbers in the column and row header) before you click the Home tab's Insert command.

TIP Rather than first selecting entire columns or rows, you can also select just one or more cells in each column or row. Then, in the Home tab's Cells group, click the Insert command's drop-down menu and then click either the Insert Sheet Columns or Insert Sheet Rows option, respectively.

REMEMBER Whenever your column or row insertions reposition data entries that are referenced in other formulas in the worksheet, Excel automatically adjusts the cell references in the formulas affected to reflect the movement of their columns left or right or rows up or down.

Splitting the worksheet into panes

Excel enables you to split the active worksheet window into two or four panes. After splitting up the window into panes, you can use the Excel workbook's horizontal and vertical scroll bars to bring different parts of the same worksheet into view. This is great for comparing the data in different sections of a table that would otherwise not be legible if you zoomed out far enough to have both sections displayed in the worksheet window.

You can split a worksheet window in three ways:

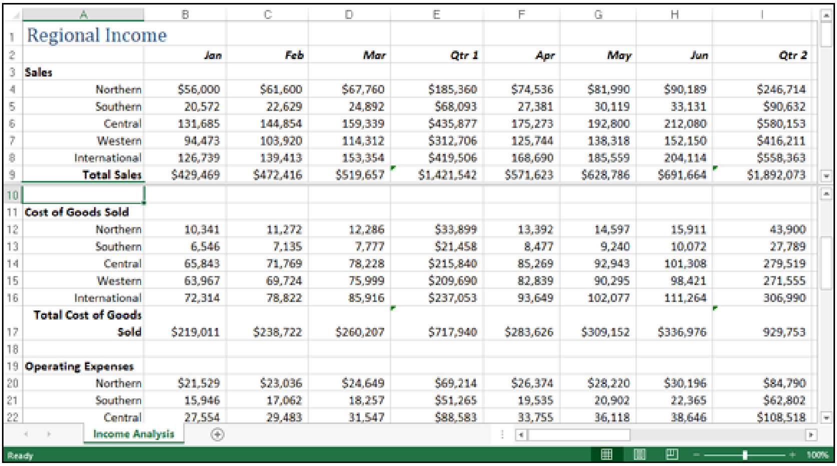
- **Two horizontal panes:** Position the cell pointer in column A of the worksheet in the cell where you want the horizontal division to take place. Every row above that cell appears in the top pane, while the cell's row and every row below it appears in the bottom pane.

- **Two vertical panes:** Position the cell pointer in the first row of the column where the split is to occur. Every column to the right of that cell appears in the right pane, while the cell's column and every column to its left appears in the left pane.
- **Four panes:** Position the cell pointer in the cell in the column to the right of where you want the vertical dividing line and in the row below where you want the horizontal dividing line. After you create the split, the cell pointer is in the upper-left corner of the lower-right pane.

To perform the split, in the View tab's Window group, click the Split button (or press Alt+WS).

Excel displays the borders of the window panes you create in the document window with a bar that ends with the vertical or horizontal split bar. To modify the size of a pane, you position the white-cross pointer on the appropriate dividing bar. When the pointer changes to either a double-headed arrow (if you're adjusting two panes) or a four-headed arrow (if you're adjusting four panes), drag the bar until the pane is the correct size and release the mouse button.

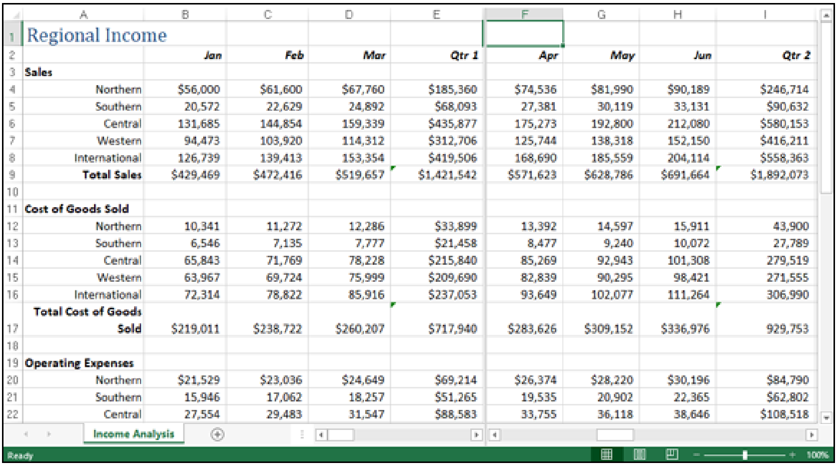
When you split a window into panes, Excel automatically synchronizes the scrolling, depending on how you split the worksheet. When you split a window into two horizontal panes, as shown in Figure 4-1 (sample workbook: Income Analysis.xlsx), the worksheet window contains a single horizontal scroll bar and two separate vertical scroll bars. This means that all horizontal scrolling of the two panes is synchronized, while the vertical scrolling of each pane remains independent.



	A	B	C	D	E	F	G	H	I
1	Regional Income								
2		*Jan*	*Feb*	*Mar*	*Qtr 1*	*Apr*	*May*	*Jun*	*Qtr 2*
3	**Sales**								
4	Northern	$56,000	$61,600	$67,760	$185,360	$74,536	$81,990	$90,189	$246,714
5	Southern	20,572	22,629	24,892	$68,093	27,381	30,119	33,131	$90,632
6	Central	131,685	144,854	159,339	$435,877	175,273	192,800	212,080	$580,153
7	Western	94,473	103,920	114,312	$312,706	125,744	138,318	152,150	$416,211
8	International	126,739	139,413	153,354	$419,506	168,690	185,559	204,114	$558,363
9	**Total Sales**	$429,469	$472,416	$519,657	$1,421,542	$571,623	$628,786	$691,664	$1,892,073
10									
11	**Cost of Goods Sold**								
12	Northern	10,341	11,272	12,286	$33,899	13,392	14,597	15,911	43,900
13	Southern	6,546	7,135	7,777	$21,458	8,477	9,240	10,072	27,789
14	Central	65,843	71,769	78,228	$215,840	85,269	92,943	101,308	279,519
15	Western	63,967	69,724	75,999	$209,690	82,839	90,295	98,421	271,555
16	International	72,314	78,822	85,916	$237,053	93,649	102,077	111,264	306,990
17	**Total Cost of Goods Sold**	$219,011	$238,722	$260,207	$717,940	$283,626	$309,152	$336,976	929,753
18									
19	**Operating Expenses**								
20	Northern	$21,529	$23,036	$24,649	$69,214	$26,374	$28,220	$30,196	$84,790
21	Southern	15,946	17,062	18,257	$51,265	19,535	20,902	22,365	$62,802
22	Central	27,554	29,483	31,547	$88,583	33,755	36,118	38,646	$108,518

FIGURE 4-1: The Regional Income worksheet with the window divided into two horizontal panes at row 10. (Sample workbook: Income Analysis.xlsx)

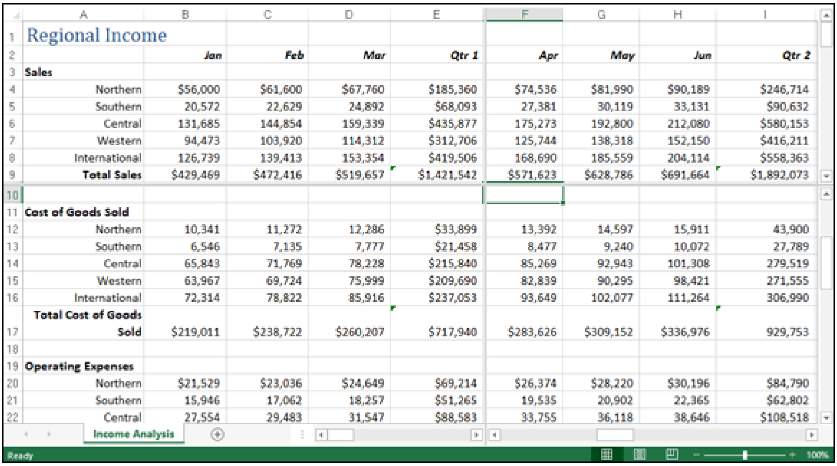
When you split a window into two vertical panes, as shown in Figure 4-2 (sample workbook: Income Analysis.xlsx), the situation is reversed. The worksheet window contains a single vertical scroll bar and two separate horizontal scroll bars. This means that all vertical scrolling of the two panes is synchronized, while horizontal scrolling of each pane remains independent.



	A	B	C	D	E	F	G	H	I
1	Regional Income								
2		*Jan*	*Feb*	*Mar*	*Qtr 1*	*Apr*	*May*	*Jun*	*Qtr 2*
3	**Sales**								
4	Northern	$56,000	$61,600	$67,760	$185,360	$74,536	$81,990	$90,189	$246,714
5	Southern	20,572	22,629	24,892	$68,093	27,381	30,119	33,131	$90,632
6	Central	131,685	144,854	159,339	$435,877	175,273	192,800	212,080	$580,153
7	Western	94,473	103,920	114,312	$312,706	125,744	138,318	152,150	$416,211
8	International	126,739	139,413	153,354	$419,506	168,690	185,559	204,114	$558,363
9	**Total Sales**	$429,469	$472,416	$519,657	$1,421,542	$571,623	$628,786	$691,664	$1,892,073
10									
11	**Cost of Goods Sold**								
12	Northern	10,341	11,272	12,286	$33,899	13,392	14,597	15,911	43,900
13	Southern	6,546	7,135	7,777	$21,458	8,477	9,240	10,072	27,789
14	Central	65,843	71,769	78,228	$215,840	85,269	92,943	101,308	279,519
15	Western	63,967	69,724	75,999	$209,690	82,839	90,295	98,421	271,555
16	International	72,314	78,822	85,916	$237,053	93,649	102,077	111,264	306,990
17	**Total Cost of Goods Sold**	$219,011	$238,722	$260,207	$717,940	$283,626	$309,152	$336,976	929,753
18									
19	**Operating Expenses**								
20	Northern	$21,529	$23,036	$24,649	$69,214	$26,374	$28,220	$30,196	$84,790
21	Southern	15,946	17,062	18,257	$51,265	19,535	20,902	22,365	$62,802
22	Central	27,554	29,483	31,547	$88,583	33,755	36,118	38,646	$108,518

FIGURE 4-2: The Regional Income worksheet with the window divided into two vertical panes at column F. (Sample workbook: Income Analysis.xlsx)

When you split a window into two horizontal and two vertical panes, as shown in Figure 4-3 (sample workbook: Income Analysis.xlsx), the worksheet window contains two horizontal scroll bars and two separate vertical scroll bars. This means that vertical scrolling is synchronized in the top two window panes when you use the top vertical scroll bar and synchronized for the bottom two window panes when you use the bottom vertical scroll bar. Likewise, horizontal scrolling is synchronized for the left two window panes when you use the horizontal scroll bar on the left, and it’s synchronized for the right two window panes when you use the horizontal scroll bar on the right.



	A	B	C	D	E	F	G	H	I
1	Regional Income								
2		*Jan*	*Feb*	*Mar*	*Qtr 1*	*Apr*	*May*	*Jun*	*Qtr 2*
3	**Sales**								
4	Northern	$56,000	$61,600	$67,760	$185,360	$74,536	$81,990	$90,189	$246,714
5	Southern	20,572	22,629	24,892	$68,093	27,381	30,119	33,131	$90,632
6	Central	131,685	144,854	159,339	$435,877	175,273	192,800	212,080	$580,153
7	Western	94,473	103,920	114,312	$312,706	125,744	138,318	152,150	$416,211
8	International	126,739	139,413	153,354	$419,506	168,690	185,559	204,114	$558,363
9	**Total Sales**	$429,469	$472,416	$519,657	$1,421,542	$571,623	$628,786	$691,664	$1,892,073
10									
11	**Cost of Goods Sold**								
12	Northern	10,341	11,272	12,286	$33,899	13,392	14,597	15,911	43,900
13	Southern	6,546	7,135	7,777	$21,458	8,477	9,240	10,072	27,789
14	Central	65,843	71,769	78,228	$215,840	85,269	92,943	101,308	279,519
15	Western	63,967	69,724	75,999	$209,690	82,839	90,295	98,421	271,555
16	International	72,314	78,822	85,916	$237,053	93,649	102,077	111,264	306,990
17	**Total Cost of Goods Sold**	$219,011	$238,722	$260,207	$717,940	$283,626	$309,152	$336,976	929,753
18									
19	**Operating Expenses**								
20	Northern	$21,529	$23,036	$24,649	$69,214	$26,374	$28,220	$30,196	$84,790
21	Southern	15,946	17,062	18,257	$51,265	19,535	20,902	22,365	$62,802
22	Central	27,554	29,483	31,547	$88,583	33,755	36,118	38,646	$108,518

FIGURE 4-3: Splitting the worksheet window into four panes: two horizontal and two vertical at cell F10. (Sample workbook: Income Analysis.xlsx)

To remove all panes from a window when you no longer need them, you click the View tab's Split button, press Alt+WS, or drag the dividing bar (with the black double-headed split arrow cursor) either for the horizontal or vertical pane until you reach one of the edges of the worksheet window. You can also remove a pane by positioning the mouse pointer on a pane-dividing bar and then, when it changes to a double-headed or four-headed split arrow, double-clicking it.

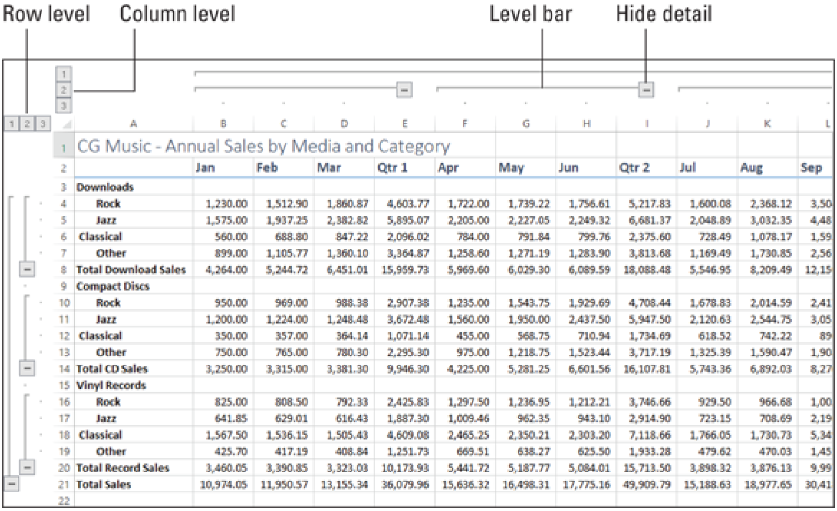
TIP

Remember that on a touchscreen, you can also remove the panes in a worksheet by directly double-tapping the pane-dividing bar with your finger or stylus.

REMEMBER You can freeze panes in the window so that information in the upper pane and/or in the leftmost pane remains in the worksheet window at all times, no matter what other columns and rows you scroll to or how much you zoom in and out on the data. (See Book 2, Chapter 3 for more on freezing panes.)

Outlining worksheets

The Outline feature enables you to control the level of detail displayed in a worksheet range or table. To outline a range or table, the data must use a uniform layout with a row of column headings identifying each column of data and summary rows that subtotal and total the data in rows above (like the CG Music Sales data shown in Figure 4-4; sample workbook: CG Music Sales.xlsx).



	A	B	C	D	E	F	G	H	I	J	K	L
1	CG Music - Annual Sales by Media and Category											
2		Jan	Feb	Mar	Qtr 1	Apr	May	Jun	Qtr 2	Jul	Aug	Sep
3	Downloads											
4	Rock	1,230.00	1,512.90	1,860.87	4,603.77	1,722.00	1,739.22	1,756.61	5,217.83	1,600.08	2,368.12	3,50
5	Jazz	1,575.00	1,937.25	2,382.82	5,895.07	2,205.00	2,227.05	2,249.32	6,681.37	2,048.89	3,032.35	4,48
6	Classical	560.00	688.80	847.22	2,096.02	784.00	791.84	799.76	2,375.60	728.49	1,078.17	1,59
7	Other	899.00	1,105.77	1,360.10	3,364.87	1,258.60	1,271.19	1,283.90	3,813.68	1,169.49	1,730.85	2,56
8	Total Download Sales	4,264.00	5,244.72	6,451.01	15,959.73	5,969.60	6,029.30	6,089.59	18,088.48	5,546.95	8,209.49	12,15
9	Compact Discs											
10	Rock	950.00	969.00	988.38	2,907.38	1,235.00	1,543.75	1,929.69	4,708.44	1,678.83	2,014.59	2,41
11	Jazz	1,200.00	1,224.00	1,248.48	3,672.48	1,560.00	1,950.00	2,437.50	5,947.50	2,120.63	2,544.75	3,05
12	Classical	350.00	357.00	364.14	1,071.14	455.00	568.75	710.94	1,734.69	618.52	742.22	89
13	Other	750.00	765.00	780.30	2,295.30	975.00	1,218.75	1,523.44	3,717.19	1,325.39	1,590.47	1,90
14	Total CD Sales	3,250.00	3,315.00	3,381.30	9,946.30	4,225.00	5,281.25	6,601.56	16,107.81	5,743.36	6,892.03	8,27
15	Vinyl Records											
16	Rock	825.00	808.50	792.33	2,425.83	1,297.50	1,236.95	1,212.21	3,746.66	929.50	966.68	1,00
17	Jazz	641.85	629.01	616.43	1,887.30	1,009.46	962.35	943.10	2,914.90	723.15	708.69	2,19
18	Classical	1,567.50	1,536.15	1,505.43	4,609.08	2,465.25	2,350.21	2,303.20	7,118.66	1,766.05	1,730.73	5,34
19	Other	425.70	417.19	408.84	1,251.73	669.51	638.27	625.50	1,933.28	479.62	470.03	1,45
20	Total Record Sales	3,460.05	3,390.85	3,323.03	10,173.93	5,441.72	5,187.77	5,084.01	15,713.50	3,898.32	3,876.13	9,99
21	Total Sales	10,974.05	11,950.57	13,155.34	36,079.96	15,636.32	16,498.31	17,775.16	49,909.79	15,188.63	18,977.65	30,41
22												

FIGURE 4-4: Automatic outline applied to the CG Music sales data with three levels of detail displayed. (Sample workbook: CG Music Sales.xlsx)

After outlining a range, you can condense the range's display when you want to see only particular levels of summary information, and you can just as easily expand the outlined range to display levels of detail data as needed. Being able to control which outline level is displayed in the worksheet makes it easy to print summary reports with levels of data (see Book 2, Chapter 5) as well as to chart just the summary data (see

Book 5, Chapter 1).

Worksheet outlines are a little different from the outlines you created in high school and college. In those outlines, you placed the headings at the highest level (I.) at the top of the outline with the intermediate headings indented below. Most worksheet outlines, however, seem backward in the sense that the highest level summary row and column are located at the bottom and far right of the table or list of data, with the columns and rows of intermediate supporting data located above and to the left of the summary row and column.

The reason that worksheet outlines often seem "backward" when compared to word-processing outlines is that, most often, to calculate your summary totals in the worksheet, you naturally place the detail levels of data above the summary rows and to the left of the summary columns that total them. When creating a word-processing outline, however, you place the major headings above subordinate headings, while at the same time indenting each subordinate level, reflecting the way we read words from left to right and down the page.

Creating the outline

To create an outline, position the cell pointer in the range or table containing the data to be outlined. In the Data tab's Outline group, click Group and then click Auto Outline (or press Alt+AGA).

By default, Excel assumes that summary rows in the selected data table are below their detail data, and summary columns are to the right of their detail data, which is normally the case. If, however, the summary rows are above the detail data, and summary columns are to the left of the detail data, Excel can still build the outline, but you need to adjust some settings.

In the Data tab's Outline group, start by clicking the dialog box launcher in the lower-right corner of the group. In the Settings dialog box that appears, deselect the Summary Rows below Detail and/or Summary Columns to Right of Detail check boxes. Also, you can have Excel automatically apply styles to different levels of the outline by selecting the Automatic Styles check box. (For more information on these styles, see the "Applying outline styles" section, later in this chapter.) To have Excel create the outline, click Create; if you click OK, instead, Excel closes the dialog box without outlining the selected worksheet data.

Figure 4-4 shows the first part of the outline created by Excel for the CG Music Sales worksheet. Note the outline symbols that Excel added to the worksheet when it created the outline. Figure 4-4 identifies most of these outline symbols (the Show Detail button with the plus sign is not displayed in this figure; see Figure 4-6), and Table 4-1 explains their functions.

TABLE 4-1 Outline Buttons

Button	*Function*
Row Level (1-8) and Column Level (1-8)	Displays a desired level of detail throughout the outline (1, 2, 3, and so on, up to 8). When you click an outline’s level bar rather than a numbered Row Level or Column Level button, Excel hides only that level in the worksheet display, the same as clicking the Hide Detail button (explained below).
Show Detail (+)	Expands the display to show the detail rows or columns that have been collapsed.
Hide Detail (–)	Condenses the display to hide the detail rows or columns that are included in its row or column level bar.

TIP If you don’t see any of the outline doodads identified in Figure 4-4 and Table 4-1, it means that Excel is configured not to show them. Open the Excel Options dialog box and display the Advanced tab (or press Alt+FTA). In the Display Options for This Worksheet section, select the Show Outline Symbols If an Outline Is Applied check box, and then click OK. Alternatively, you can press Ctrl+8 to toggle the display of the outline symbols.

REMEMBER You can have only one outline per worksheet. If you’ve already outlined one table and then try to outline another table on the same worksheet, Excel displays the Modify Existing Outline alert box when you click the Outline command. If you click OK, Excel adds the outlining for the new table to the existing outline for the first table (even though the tables are nonadjacent). To create separate outlines for different data tables, you need to place each table on a different worksheet of the workbook.

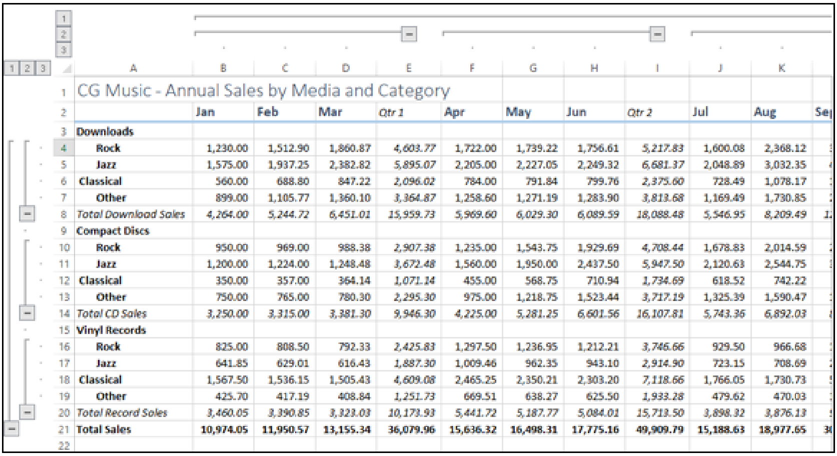
Applying outline styles

You can apply predefined row and column outline styles to your data.

To apply these styles when creating the outline, don't use the Auto Outline method. Instead, in the Data tab's Outline group, click the dialog box launcher in the lower-right corner to open the Settings dialog box, select the Automatic Styles check box, and then click Create.

If your outline is already displayed, you can still apply the outline styles. First, select all the cells in the outlined range. In the Data tab's Outline group, click the dialog box launcher in the lower-right corner to open the Settings dialog box, select the Automatic Styles check box, and then click Apply Styles.

Figure 4-5 (sample workbook: CG Music Sales.xlsx) shows you the sample CG Music Sales table after I applied the automatic row and column styles to the outlined table data. In this example, Excel applied two row styles (RowLevel_1 and RowLevel_2) and two column styles (ColLevel_1 and ColLevel_2) to the worksheet table.



	A	B	C	D	E	F	G	H	I	J	K
1	CG Music - Annual Sales by Media and Category										
2		Jan	Feb	Mar	*Qtr 1*	Apr	May	Jun	*Qtr 2*	Jul	Aug
3	**Downloads**										
4	**Rock**	1,230.00	1,512.90	1,860.87	*4,603.77*	1,722.00	1,739.22	1,756.61	*5,217.83*	1,600.08	2,368.12
5	**Jazz**	1,575.00	1,937.25	2,382.82	*5,895.07*	2,205.00	2,227.05	2,249.32	*6,681.37*	2,048.89	3,032.35
6	**Classical**	560.00	688.80	847.22	*2,096.02*	784.00	791.84	799.76	*2,375.60*	728.49	1,078.17
7	**Other**	899.00	1,105.77	1,360.10	*3,364.87*	1,258.60	1,271.19	1,283.90	*3,813.68*	1,169.49	1,730.85
8	*Total Download Sales*	*4,264.00*	*5,244.72*	*6,451.01*	*15,959.73*	*5,969.60*	*6,029.30*	*6,089.59*	*18,088.48*	*5,546.95*	*8,209.49*
9	**Compact Discs**										
10	**Rock**	950.00	969.00	988.38	*2,907.38*	1,235.00	1,543.75	1,929.69	*4,708.44*	1,678.83	2,014.59
11	**Jazz**	1,200.00	1,224.00	1,248.48	*3,672.48*	1,560.00	1,950.00	2,437.50	*5,947.50*	2,120.63	2,544.75
12	**Classical**	350.00	357.00	364.14	*1,071.14*	455.00	568.75	710.94	*1,734.69*	618.52	742.22
13	**Other**	750.00	765.00	780.30	*2,295.30*	975.00	1,218.75	1,523.44	*3,717.19*	1,325.39	1,590.47
14	*Total CD Sales*	*3,250.00*	*3,315.00*	*3,381.30*	*9,946.30*	*4,225.00*	*5,281.25*	*6,601.56*	*16,107.81*	*5,743.36*	*6,892.03*
15	**Vinyl Records**										
16	**Rock**	825.00	808.50	792.33	*2,425.83*	1,297.50	1,236.95	1,212.21	*3,746.66*	929.50	966.68
17	**Jazz**	641.85	629.01	616.43	*1,887.30*	1,009.46	962.35	943.10	*2,914.90*	723.15	708.69
18	**Classical**	1,567.50	1,536.15	1,505.43	*4,609.08*	2,465.25	2,350.21	2,303.20	*7,118.66*	1,766.05	1,730.73
19	**Other**	425.70	417.19	408.84	*1,251.73*	669.51	638.27	625.50	*1,933.28*	479.62	470.03
20	*Total Record Sales*	*3,460.05*	*3,390.85*	*3,323.03*	*10,173.93*	*5,441.72*	*5,187.77*	*5,084.01*	*15,713.50*	*3,898.32*	*3,876.13*
21	**Total Sales**	**10,974.05**	**11,950.57**	**13,155.34**	**36,079.96**	**15,636.32**	**16,498.31**	**17,775.16**	**49,909.79**	**15,188.63**	**18,977.65**
22											

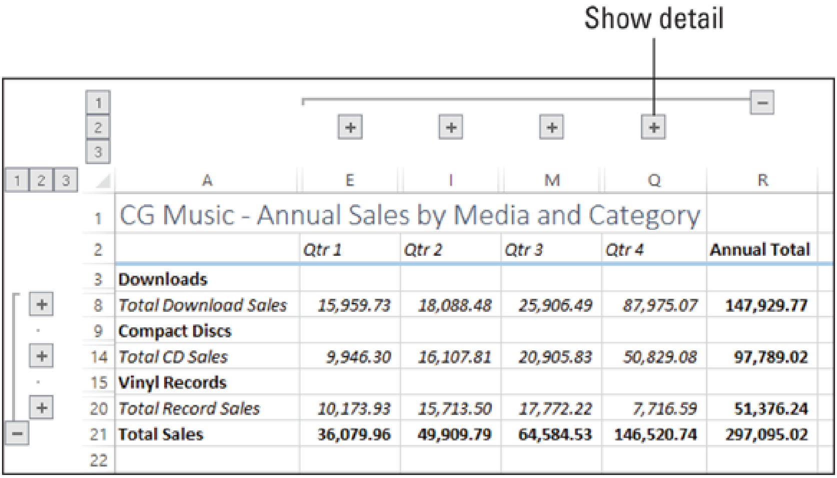
FIGURE 4-5: The outline after applying automatic styles with the Settings dialog box. (Sample workbook: CG Music Sales.xlsx)

The RowLevel_1 style is applied to the entries in the first-level summary row (row 21) and makes the font appear in bold. The ColLevel_1 style is applied to the data in the first-level summary column (column R, which isn’t shown in the figure), and it, too, makes the font bold. The RowLevel_2 style is applied to the data in the second-level rows (rows 8, 14, and 20), and this style adds italics to the font. The ColLevel_2 style is applied to all second-level summary columns (columns E, I, M, and Q), and it also italicizes the font. (Note that columns M and Q are also not visible in Figure 4-5.)

TIP Sometimes Excel can get a little finicky about applying styles to an existing outline. If, in the Settings dialog box, you click the Automatic Styles check box, click the Apply Styles button, and nothing happens to your outline, re-create the outline by selecting the Data tab's Group⇒ Auto Outline command in the Outline group. Excel displays an alert dialog box asking you to confirm that you want to modify the existing outline. When you click OK, Excel redisplays your outline, this time with the automatic styles applied.

Displaying and hiding different outline levels

The real effectiveness of outlining worksheet data becomes apparent when you start using the outline symbols to change the way the data are displayed in the worksheet. By clicking the appropriate row or column level symbol, you can immediately hide detail rows and columns to display just the summary information in the table. For example, Figure 4-6 (sample workbook: CG Music Sales.xlsx) shows you the CG Music Sales table after clicking the number 2 Row Level button and number 2 Column Level button. Here, you see only the first- and second-level summary information; that is, the totals for the quarterly and annual totals for the three types of music sales.



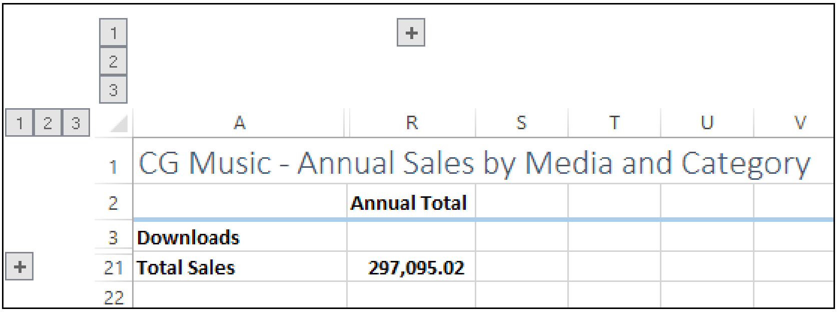
Show detail

	A	E	I	M	Q	R
1	CG Music - Annual Sales by Media and Category					
2		*Qtr 1*	*Qtr 2*	*Qtr 3*	*Qtr 4*	**Annual Total**
3	**Downloads**					
8	*Total Download Sales*	*15,959.73*	*18,088.48*	*25,906.49*	*87,975.07*	**147,929.77**
9	**Compact Discs**					
14	*Total CD Sales*	*9,946.30*	*16,107.81*	*20,905.83*	*50,829.08*	**97,789.02**
15	**Vinyl Records**					
20	*Total Record Sales*	*10,173.93*	*15,713.50*	*17,772.22*	*7,716.59*	**51,376.24**
21	**Total Sales**	**36,079.96**	**49,909.79**	**64,584.53**	**146,520.74**	**297,095.02**
22						

FIGURE 4-6: Collapsed worksheet outline showing first- and secondary-level summary information. (Sample workbook: CG Music Sales.xlsx)

TIP You can also hide and display levels of the outlined data via the Ribbon. First, position the cell cursor in the column or row. Then, in the Data tab's Outline group, click either Hide Detail (or press Alt + AJ) or Show Detail (or press Alt + AH). The great thing about using these buttons or their hot key equivalents is that they work even when the outline symbols are not displayed in the worksheet.

Figure 4-7 (sample workbook: CG Music Sales.xlsx) shows you the same table, this time after clicking the number 1 Row Level button and number 1 Column Level button. Here, you see only the first-level summary for the column and the row, that is, the grand total of the annual CG Music sales. To expand this view horizontally to see the total sales for each quarter, you would click the number 2 Column Level button. To expand this view even further horizontally to display each monthly total in the worksheet, you would click the number 3 Column Level button. So too, to expand the outline vertically to see totals for each type of media, you would click the number 2 Row Level button. To expand the outline one more level vertically so that you can see the sales for each type of music as well as each type of media, you would click the number 3 Row Level button.

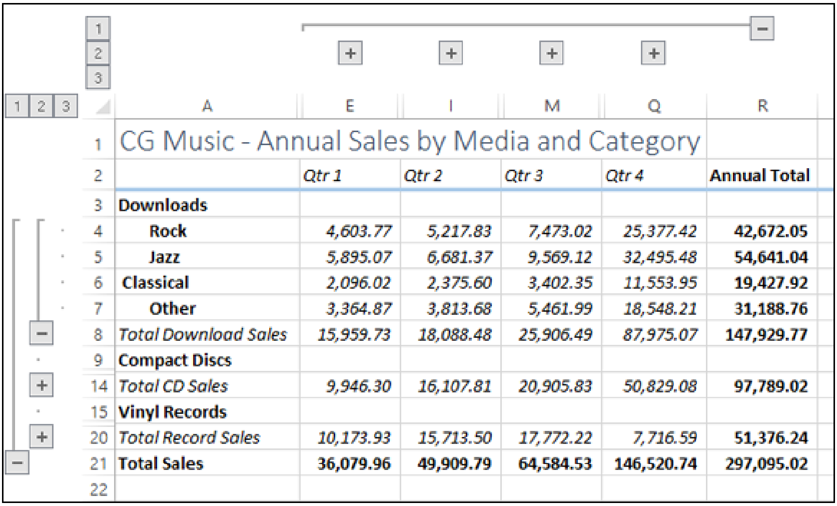


	A	R	S	T	U	V
1	CG Music - Annual Sales by Media and Category					
2		**Annual Total**				
3	**Downloads**					
21	**Total Sales**	**297,095.02**				
22						

FIGURE 4-7: Totally collapsed worksheet outline showing only the first-level summary information. (Sample workbook: CG Music Sales.xlsx)

When displaying different levels of detail in a worksheet outline, you can use the Hide Detail and Show Detail buttons along with the Row Level and Column Level buttons. For example, Figure 4-8 (sample workbook: CG Music Sales.xlsx) shows you another view of the CG Music outlined sales table. Here, in the horizontal dimension, you see all three column levels have been expanded, including the monthly detail columns for each quarter. In the vertical dimension, however, only the detail rows for the Download sales have been expanded. The detail rows for the CD and Vinyl Record sales are still collapsed.

To create this view of the outline, you click the number 2 Column Level and Row Level buttons, and then click only the Show Detail (+) button located to the left of the Total Download Sales row heading. When you want to view only the summary-level rows for each media type, you can click the Hide Detail (–) button to the left of the Total Download Sales heading, or you can click its level bar (drawn from the collapse symbol up to the first music type to indicate all the detail rows included in that level).



	A	E	I	M	Q	R
1	CG Music - Annual Sales by Media and Category					
2		*Qtr 1*	*Qtr 2*	*Qtr 3*	*Qtr 4*	**Annual Total**
3	**Downloads**					
4	**Rock**	*4,603.77*	*5,217.83*	*7,473.02*	*25,377.42*	**42,672.05**
5	**Jazz**	*5,895.07*	*6,681.37*	*9,569.12*	*32,495.48*	**54,641.04**
6	**Classical**	*2,096.02*	*2,375.60*	*3,402.35*	*11,553.95*	**19,427.92**
7	**Other**	*3,364.87*	*3,813.68*	*5,461.99*	*18,548.21*	**31,188.76**
8	*Total Download Sales*	*15,959.73*	*18,088.48*	*25,906.49*	*87,975.07*	**147,929.77**
9	**Compact Discs**					
14	*Total CD Sales*	*9,946.30*	*16,107.81*	*20,905.83*	*50,829.08*	**97,789.02**
15	**Vinyl Records**					
20	*Total Record Sales*	*10,173.93*	*15,713.50*	*17,772.22*	*7,716.59*	**51,376.24**
21	**Total Sales**	**36,079.96**	**49,909.79**	**64,584.53**	**146,520.74**	**297,095.02**
22						

FIGURE 4-8: Worksheet outline expanded to show only details for Download sales for all four quarters. (Sample workbook: CG Music Sales.xlsx)

REMEMBER Excel adjusts the outline levels displayed on the screen by hiding and redisplaying entire columns and rows in the worksheet. Therefore, changes that you make that reduce the number of levels displayed in the outlined table also hide the display of all data outside of the outlined table that are in the affected rows and columns.

TIP After selecting the rows and columns you want displayed, you can then remove the outline symbols from the worksheet display to maximize the amount of data displayed onscreen. To do this, press Ctrl + 8.

Manually adjusting the outline levels

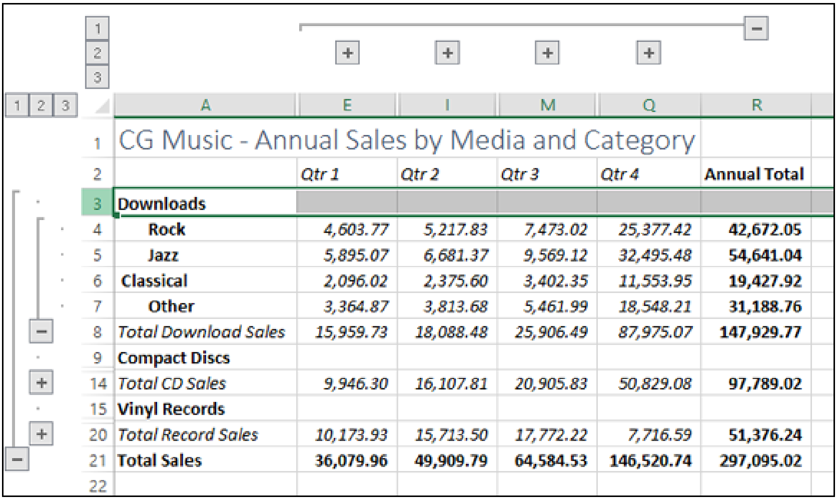
Most of the time, Excel’s Auto Outline feature correctly outlines the data in your range or table. Every once in a while, however, you'll have to manually adjust one or more of the outline levels so that the outline’s summary rows and columns include the right detail rows and columns. To adjust levels of a worksheet outline, you must select the rows or columns that you want to promote to a higher level (that is, one with a lower level number) in the outline and then click the Group button on the far right side of the Data tab of the Ribbon. If you want to demote selected rows or columns to a lower level in the outline, select the rows or columns with a higher level number and then click the Ungroup button on the Data tab.

Before you use the Group and Ungroup buttons to change an outline level, you must select the rows or columns that you want to promote or demote. To select a particular outline level and all the rows and columns included in that level, you need to display the outline symbols (Ctrl + 8), and then hold down the Shift key as you click its collapse or expand symbol. Note that when you click an expand symbol, Excel selects not only the rows or columns visible at that level, but all the hidden rows and columns included in that level as well. If you want to select only a particular detail or summary row or column in the outline, you can click that row number or column letter in the worksheet window, or you can hold down the Shift key and click the dot (period) to the left of the row number or above the column letter in the outline symbols area.

If you select only a range of cells in the rows or columns (as opposed to entire rows and columns) before you click the Group and Ungroup command buttons, Excel displays the Group or Ungroup dialog box, which contains a Rows and Columns option button (with the Rows button selected by default). To promote or demote columns instead of rows, click the Columns option button before you click OK. To close the dialog box without promoting or demoting any part of the outline, click Cancel.

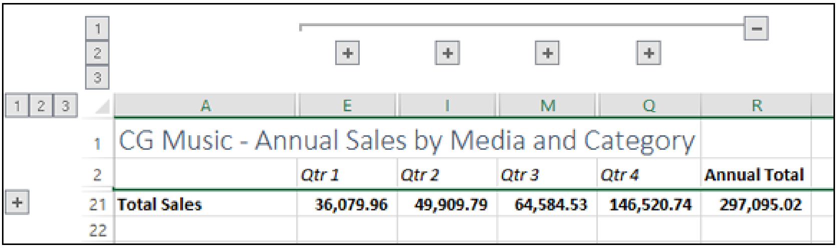
To see how you can use the Group and Ungroup command buttons on the Data tab of the Ribbon to adjust outline levels, consider once again the CG Music Sales outline. When Excel created this outline, the program didn't include row 3 (which contains only the row heading, Downloads) in the outline. As a result, when you collapse the rows by selecting the number 1 Row Level button to display only the first-level Total Sales summary row (refer to Figure 4-7), this Downloads row heading remains visible in the table, even though it should have been included and thereby hidden along with the other summary and detail rows.

You can use the Group command button to move this row (3) down a level so that it's included in the first level of the outline. You click the row header 3 to select the row and then click the Group command button on the Data tab (or press Alt+AGG). Figure 4-9 (sample workbook: CG Music Sales.xlsx) shows you the result of doing this. Notice how the outside level bar (for level 1) now includes this row. Now, when you collapse the outline by clicking the number 1 row level button, the heading in row 3 is hidden as well, as shown in Figure 4-10 (sample workbook: CG Music Sales.xlsx).



	A	E	I	M	Q	R
1	CG Music - Annual Sales by Media and Category					
2		Qtr 1	Qtr 2	Qtr 3	Qtr 4	Annual Total
3	Downloads					
4	Rock	4,603.77	5,217.83	7,473.02	25,377.42	42,672.05
5	Jazz	5,895.07	6,681.37	9,569.12	32,495.48	54,641.04
6	Classical	2,096.02	2,375.60	3,402.35	11,553.95	19,427.92
7	Other	3,364.87	3,813.68	5,461.99	18,548.21	31,188.76
8	Total Download Sales	15,959.73	18,088.48	25,906.49	87,975.07	147,929.77
9	Compact Discs					
14	Total CD Sales	9,946.30	16,107.81	20,905.83	50,829.08	97,789.02
15	Vinyl Records					
20	Total Record Sales	10,173.93	15,713.50	17,772.22	7,716.59	51,376.24
21	Total Sales	36,079.96	49,909.79	64,584.53	146,520.74	297,095.02
22						

FIGURE 4-9: Manually adjusting the level 1 rows in the worksheet outline. (Sample workbook: CG Music Sales.xlsx)



	A	E	I	M	Q	R
1	CG Music - Annual Sales by Media and Category					
2		Qtr 1	Qtr 2	Qtr 3	Qtr 4	Annual Total
21	**Total Sales**	**36,079.96**	**49,909.79**	**64,584.53**	**146,520.74**	**297,095.02**
22						

FIGURE 4-10: Collapsing the adjusted worksheet outline to the first level summary information. (Sample workbook: CG Music Sales.xlsx)

Removing an outline

To delete an outline from your worksheet, display the Data tab, and then in the Outline group, click the drop-down button attached to the Ungroup button and then click Clear Outline (or you can press Alt + AUC). Note that removing the outline doesn't affect the data in any way — Excel merely removes the outline structure. Also note that it doesn't matter what state the outline is in at the time you select this command. If the outline is partially or totally collapsed, deleting the outline automatically displays all the hidden rows and columns in the data table or list.

REMEMBER Restoring an outline that you've removed isn't one of the commands that you can undo (Ctrl + Z). If you clear an outline by mistake, you must re-create it all over again. For this reason, most often you'll want to expand all the outline levels (by clicking the lowest number column and row level button) and then hide all the outline symbols by pressing Ctrl + 8 rather than permanently remove the outline. Note that if you press Ctrl + 8 when your worksheet table isn't yet outlined, Excel displays an alert dialog box indicating that it can't show the outline symbols because no outline exists. This alert also asks you whether you want to create an outline. To go ahead and outline the worksheet, click OK or press Enter. To remove the alert dialog box without creating an outline, click Cancel.

Creating different custom views of the outline

After you've created an outline for your worksheet table, you can create custom views that display the table in levels of detail. Then, instead of having to display the outline symbols and manually click the Show Detail and Hide Detail buttons or the appropriate row level buttons and/or column level buttons to view a particular level of detail, you select the appropriate outline view in the Custom Views dialog box (View⇒ Custom Views or Alt+WCV).

When creating custom views of outlined worksheet data, be sure that you leave the Hidden Rows, Columns, and Filter Settings check box selected in the Include in View section of the Add View dialog box. (See Book 2, Chapter 3 for details on creating and using custom views in a worksheet.)

Reorganizing the Workbook

Any new workbook that you open already comes with a single blank worksheet. Although most of the workbooks you create and work with may never wander beyond the confines of this one worksheet, you do need to know how to organize your worksheet information three-dimensionally for those occasions when spreading out all the information in one sprawling worksheet is not practical. However, the normal, everyday problems related to keeping on top of the information in a single worksheet can easily get out of hand when you use multiple worksheets in a workbook. For this reason, you need to be sure that you are fully versed in the basics of using multiple worksheets.

The sheet tabs shown at the bottom of each workbook are the keys to keeping your place in a workbook. To tell which sheet is current, you have only to look at which sheet tab appears on the top, matches the background of the other cells in the worksheet, and has its name displayed in bold type and underlined.

REMEMBER To move between the sheets in a workbook, you can click the sheet tab for that worksheet or press Ctrl+PgDn (next sheet) or Ctrl+PgUp (preceding sheet) until the sheet is selected. If the sheet tab for the worksheet you want isn't displayed on the scroll bar at the bottom of the document window, use the tab scrolling buttons (the buttons with the left- and right-pointing triangles) to bring it into view.

To use the tab scrolling buttons, click the one with the right-pointing triangle to bring the next sheet into view and click the one with the left-pointing triangle to bring the preceding sheet into view. Ctrl-click the tab scrolling buttons with the directional triangles to display the very first or very last group of sheet tabs in a workbook. Ctrl-clicking the button with the triangle pointing left to a vertical line brings the first group of sheet tabs into view; Ctrl-clicking the button with the triangle pointing right to a vertical line brings the last group of sheet tabs into view. When you scroll sheet tabs to find the one you're looking for, don't forget to click the desired sheet tab to make the worksheet current.

TIP Right-click either of the tab scrolling buttons to display the Activate dialog box. This dialog box displays the names of all the worksheets in the current workbook in their current order. You can then scroll to and activate any of the sheets by selecting them followed by OK or by double-clicking them.

REMEMBER Excel indicates that more worksheets are in a workbook whose tabs are not visible by adding a continuation button (indicated by an *ellipsis,* that is, three dots in a row) either immediately following the last visible tab on the right or the first visible tab on the left. Keep in mind that you can also scroll the next or previously hidden sheet tab into view by clicking the continuation button on the right of the last visible sheet tab or left of the first visible tab, respectively.

Renaming a worksheet

When you add new worksheets to a new workbook, Excel gives each one a default sheet name along the lines of Sheet2, Sheet3, and so on. Boring! And not helpful because these default names don't describe the content of the worksheet. To make it easier to navigate and work with multi-sheet workbooks, you should give all your worksheets short, descriptive names.

To rename a worksheet, you take these steps:

1. **Bring the worksheet tab into view, if it's not already.**
2. **Double-click the worksheet tab. Alternatively,**

choose Home⇒ Format⇒ Rename Sheet. (You can also press Alt+HOR or right-click the sheet tab and then click Rename.)

Excel opens the tab name text for editing and positions the insertion point at the end of the name.

3. **Replace or edit the name on the sheet tab and press Enter.**

   Note that the name must be unique in the workbook, no longer than 31 characters, and can include any character except the following: \ / ? * [ ] and :.

When you rename a worksheet in this manner, keep in mind that Excel then uses that sheet name in any formulas that refer to cells in that worksheet. So, for instance, if you rename Sheet2 to Sales and then create a formula in cell A10 of Sheet1 that adds its cell B10 to cell C34 in Sheet2, the formula in cell A10 becomes

```
=B10+Sales!C34
```

This is in place of the more obscure =B10+Sheet2!C34. For this reason, keep your sheet names short and to the point so that you can easily and quickly identify the sheet and its data without creating excessively long formula references.

Designer sheets

Excel makes it easy to color-code the worksheets in your workbook. This makes it possible to create a color scheme that helps either identify or prioritize the sheets and the information they contain.

REMEMBER When you color a sheet tab, note that the tab appears in that color only when it's not the active sheet. The moment you select a color-coded sheet tab, it becomes white with just a gradient of the assigned color appearing under the sheet name. Note, too, that when you assign darker colors to a sheet tab, Excel automatically reverses out the sheet name text to white when the worksheet is not active.

Color coding sheet tabs

To assign a new color to a sheet tab, follow these three steps:

1. **Click the tab you want to color if it's displayed at the bottom of the workbook window. Otherwise, press Ctrl + PgDn until the sheet is active.**

   Don't forget that you have to select and activate the sheet whose tab you want to color, or you end up coloring the tab of whatever sheet happens to be current at the time you perform the next step.

2. **On the Home tab, click the Format button (or press Alt + HOT).**

   Excel displays a color palette.

   An alternative way to display the color palette is to right-click the tab and then click Tab Color on the shortcut menu that appears.

3. **Click the color you want to assign to the current sheet tab.**

REMEMBER To remove color-coding from a sheet tab, repeat Steps 1 and 2, and then click the No Color command near the bottom of the color palette.

Assigning a graphic image as the sheet background

If coloring the sheet tabs isn't enough for you, you can also assign a graphic image to be used as the background for all the cells in the entire worksheet. Just be aware that the background image must either be very light in color or use a greatly reduced opacity for your worksheet data to be read over the image. This probably makes most graphics that you have readily available unusable as worksheet background images. It can, however, be quite effective if you have a special corporate watermark graphic (as with the company's logo at extremely low opacity) that adds just a hint of a background without obscuring the data being presented in its cells.

To add a local graphic file as the background for a worksheet, take these steps:

1. **Click the sheet tab if it’s displayed at the bottom of the workbook window, or press Ctrl+PgDn until the sheet is active.**

   Don’t forget that you have to select and activate the sheet to which the graphic file will act as the background, or you end up assigning the file to whatever sheet happens to be current at the time you perform the following steps.

2. **In the Page Layout tab's Page Setup group, click the Background command (or press Alt+PG).**

   Excel opens the Insert Pictures dialog box.

3. **Click the Browse button to the right of the From a File link.**

   Excel opens the Sheet Background dialog box.

4. **Open the folder that contains the image you want to use, click the image file, and then click Insert.**

   Excel applies the image as the background for all cells in the current worksheet. (Usually, the program does this by stretching the graphic so that it takes up all the cells that are visible in the Workbook window. In the case of some smaller images, the program does this by tiling the image so that it’s duplicated across and down the viewing area.)

REMEMBER A graphic image that you assign as the worksheet background doesn’t appear in the printout, unlike the pattern and background colors that you assign to ranges of cells in the sheet.

To remove a background image, click the Page Layout tab's Delete Background command (which replaces the Background button when you assign a background image to a worksheet) or press Alt+PG again.

TIP You can also turn online graphics into worksheet backgrounds. Select the Page Layout tab's Background command and use the Bing Image Search text box to search for the image you want to use. (See Book 5, Chapter 2 for details.) When you locate the online image you want to use, double-click its thumbnail to download the image and insert it into the current worksheet as the sheet's background.

Adding worksheets

You can add as many worksheets as you need to build out your workbook model. To add a new worksheet, click the New Sheet button (the plus inside a circle icon), which always appears immediately to the right of the last sheet tab in the workbook.

Excel inserts a new worksheet after whatever sheet was active when you clicked New Sheet and the program assigns it the next available sheet number (Sheet2, Sheet3, Sheet4, and so on).

REMEMBER You can also insert a new sheet (and not necessarily a blank worksheet) into the workbook by right-clicking a sheet tab and then clicking Insert at the top of the tab's shortcut menu. Excel opens the Insert dialog box containing different file icons that you can select — Worksheet, Chart, MS Excel 4.0 Macro, and MS Excel 5.0 Dialog, along with a variety of different worksheet templates. Click Worksheet to insert a blank worksheet; click Chart to insert a specialized chart sheet (see Book 5, Chapter 1); click MS Excel 4.0 Macro to insert a macro sheet (Book 8, Chapter 1); click MS Excel 5.0 to insert a sheet for a custom dialog box; or click a template to insert a worksheet that follows a template design (Book 2, Chapter 1). Note that when you insert a new sheet using the Insert dialog box, Excel inserts the new sheet to the left of the worksheet that's active (in contrast to clicking the New Sheet button, which inserts the new sheet to the right of the active worksheet).

TIP If you find that a single worksheet just never seems sufficient for the kind of workbooks you normally create, you can change the default number of sheets that are automatically available in all new workbook files that you open. To do this, open the Excel Options dialog box (File⇒ Options or Alt+FT) and select the General tab. Then use the Include This Many Sheets text box to specify the default number of worksheets you want to see in each new workbook you create (up to a maximum of 255).

Deleting worksheets

To remove a worksheet, first make the sheet active. Then, in the Home tab's Cells group, click the Delete drop-down button and choose Delete Sheet from its drop-down menu (or press Alt+HDS). Alternatively, right-click the worksheet's tab and then click Delete from its shortcut menu. If Excel detects that the worksheet contains some data, the program then displays an alert dialog box cautioning you that the worksheet you're about to zap will be permanently deleted. To go ahead and delete the sheet (data and all), click Delete. To preserve the worksheet, click Cancel or press the Escape key.

WARNING Deleting a sheet is one of those actions that you can't undo with the Undo button on the Quick Access toolbar. This means that after you click the Delete button, you've kissed your worksheet goodbye, so don't do this unless you're *certain* that you aren't dumping needed data. Also, keep in mind that you can't delete a worksheet if that sheet is the only one in the workbook until you've inserted another blank worksheet: Excel won't allow a workbook file to be completely sheetless.

Changing the sheets

Excel enables you to rearrange the order of the sheets in your workbook. To move a sheet, click and drag its sheet tab to the new position in the row of tabs. As you drag, the pointer changes shape to an arrowhead on a dog-eared piece of paper, and you see a black triangle pointing downward above the sheet tabs. When this triangle is positioned where you want the sheet moved, release the mouse button.

If you need to copy a worksheet to another position in the workbook, hold down the Ctrl key as you click and drag the sheet tab. As you drag, the pointer changes shape to an arrowhead on a dog-eared piece of paper that includes a plus sign (+), and you see a black triangle pointing downward above the sheet tabs. When this triangle is positioned where you want the sheet copied, release the mouse button. Excel creates a copy with a new sheet tab name based on the number of the copy and the original sheet name. For example, if you copy Sheet1 to a new place in the workbook, the first copy is renamed Sheet1 (2) (the next copy would be Sheet1 (3), and so on). You can then rename the worksheet whatever you want.

You can also move or copy a worksheet by right-clicking its sheet tab and then choosing the Move or Copy command to open the Move or Copy dialog box. In the Before Sheet list box, click the name of the worksheet that you want the currently active worksheet to now precede. If you want to copy the worksheet, select the Create a Copy check box. Click OK to make it so.

Editing and formatting multiple worksheets as a group

If you're working on a bunch of worksheets that share essentially the same layout and require the same type of formatting, you may not have to edit and format the sheets individually. Excel offers the welcome capability of editing and formatting more than one worksheet at a time. A collection of two or more selected worksheets is called a *group*.

For example, suppose that you have a workbook that contains annual sales worksheets (named YTD2020, YTD2021, and YTD2022) for three consecutive years. The worksheets share the same layout (with months across the columns and quarterly and annual totals, locations, and types of sales down the rows) but lack standard formatting.

To format any part of these three worksheets in a single operation, you resort to group editing, which requires selecting the three sales worksheets. Click the YTD2020 sheet tab, hold down Ctrl, and click the YTD2021 and YTD2022 sheet tabs. Alternatively, if the three sheets appear consecutively, you can click the YTD2020 tab and then hold down the Shift key as you click the YTD2022 tab.

After you select the last sheet, the Group indicator appears in the title bar of the active document window.

The Group indicator lets you know that any editing changes you make to the current worksheet will affect all the sheets that are currently selected. For example, if you select a row of column headings and add bold and italics to the headings in the current worksheet, the same formatting is applied to the same cell selection in all the selected sheets. All headings in the same cell range in the other worksheets are now in bold and italics. Keep in mind that you can apply not only formatting changes to a cell range, but also editing changes, such as replacing a cell entry, deleting a cell's contents, or moving a cell selection to a new place in the worksheet. These changes affect all the worksheets you have selected as long as they're grouped together.

After you're finished making editing changes that affect all the grouped worksheets, you can break up the group by right-clicking one of the grouped sheet tabs and then clicking Ungroup Sheets at the top of the shortcut menu. As soon as you break up the group, the Group indicator disappears from the title bar. Any editing or formatting changes that you make once again affect only the cells in the active worksheet.

TIP To select all the worksheets in the workbook for group editing in one operation, right-click the tab of the sheet where you want to make the editing changes that affect all the other sheets, and then choose Select All Sheets from its shortcut menu.

Hiding worksheets

Another technique that comes in handy when working with multiple worksheets is hiding particular worksheets in the workbook. Just as you can hide particular columns, rows, and cell ranges in a worksheet, you can also hide particular worksheets in the workbook. For example, you may want to hide a worksheet that contains sensitive (for-your-eyes-only) material, such as the one with all the employee salaries in the company or the one that contains all the macros used in the workbook.

As with hiding columns and rows, hiding worksheets enables you to share onscreen or print the contents of the workbook without the data in worksheets that you consider either unnecessary or too private for widespread distribution but which, nonetheless, are required in the workbook. Then after you've finished sharing the workbook onscreen or after the workbook is printed, you can redisplay the worksheets by unhiding them.

To hide a worksheet, first make it active by selecting its sheet tab. In the Home tab's Cells group, click the Format command, and then click Hide & Unhide⇒ Hide Sheet (or press Alt+HOUS). Alternatively, right-click the worksheet tab and then click Hide. Excel temporarily removes this worksheet’s tab from the row of sheet tabs.

To redisplay any of the sheets you’ve hidden, click the Home tab's Format command, then click Hide & Unhide⇒ Unhide Sheet (or press Alt+HOUH) to display the Unhide dialog box. Alternatively, right-click any worksheet tab and then click Unhide.

In the Unhide Sheet list box, click the name of the sheet that you want to display once again in the workbook. If you want to restore multiple sheets, hold down Ctrl and click each sheet you want to unhide. Click OK and Excel redisplays the hidden worksheet (or worksheets).

Opening windows on different sheets

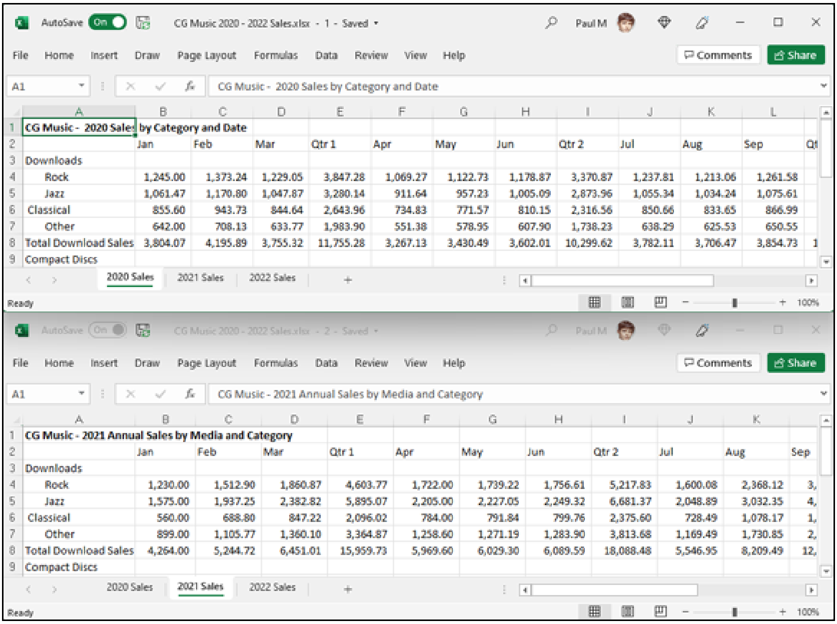
The biggest problem with keeping your worksheet data on different worksheets rather than keeping it all together on the same sheet is being able to compare the information on the different sheets. When you use a single worksheet, such comparisons aren't so bad because you can split the workbook window into horizontal or vertical panes (see “Splitting the worksheet into panes,” earlier in this chapter) and then scroll different sections of the sheet into view.

If you want to compare data located in different worksheets, however, you need to open new windows for the workbook — one for each worksheet you want to view. You then arrange the windows so that you can see the data you want to compare from all the worksheets. However, rather than fussing with moving and sizing windows, you can get Excel to do the heavy lifting by running the View Side by Side command to tile the windows one above the other and automatically synchronize the scrolling between them.

Comparing worksheet windows side by side

Figure 4-11 helps illustrate how the View Side by Side feature works. This figure contains two windows showing parts of two different worksheets (2020 Sales and 2021 Sales) in the same workbook (`CG Music 2020 - 2022 Sales.xlsx`). These windows are arranged horizontally so that they fit one above the other and to show more data, I have unpinned the Ribbon in both windows so that only the row of tabs are visible.

As you can see, the top window shows the upper-left portion of the first worksheet with the 2020 sales data, while the lower window shows the upper-left portion of the second worksheet with the 2021 sales data. Note that both windows contain the same sheet tabs (although different tabs are active in the different windows) but that only the top, active window is equipped with a set of horizontal and vertical scroll bars. However, because Excel automatically synchronizes the scrolling between the windows, you can use the single set of scroll bars to bring different sections of the two sheets into view.


AutoSave On
CG Music 2020 - 2022 Sales.xlsx - 1 - Saved
Paul M
File
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Help
Comments
Share
A1
2020 Sales
2021 Sales
2022 Sales
Ready
100%
AutoSave On
CG Music 2020 - 2022 Sales.xlsx - 2 - Saved
Paul M
File
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Help
Comments
Share
A1
2020 Sales
2021 Sales
2022 Sales
Ready
100%

CG Music - 2020 Sales by Category and Date

	A	B	C	D	E	F	G	H	I	J	K	L	
1	CG Music - 2020 Sales by Category and Date												
2		Jan	Feb	Mar	Qtr 1	Apr	May	Jun	Qtr 2	Jul	Aug	Sep	Qt
3	Downloads												
4	Rock	1,245.00	1,373.24	1,229.05	3,847.28	1,069.27	1,122.73	1,178.87	3,370.87	1,237.81	1,213.06	1,261.58	
5	Jazz	1,061.47	1,170.80	1,047.87	3,280.14	911.64	957.23	1,005.09	2,873.96	1,055.34	1,034.24	1,075.61	
6	Classical	855.60	943.73	844.64	2,643.96	734.83	771.57	810.15	2,316.56	850.66	833.65	866.99	
7	Other	642.00	708.13	633.77	1,983.90	551.38	578.95	607.90	1,738.23	638.29	625.53	650.55	
8	Total Download Sales	3,804.07	4,195.89	3,755.32	11,755.28	3,267.13	3,430.49	3,602.01	10,299.62	3,782.11	3,706.47	3,854.73	1
9	Compact Discs												

CG Music - 2021 Annual Sales by Media and Category

	A	B	C	D	E	F	G	H	I	J	K	
1	CG Music - 2021 Annual Sales by Media and Category											
2		Jan	Feb	Mar	Qtr 1	Apr	May	Jun	Qtr 2	Jul	Aug	Sep
3	Downloads											
4	Rock	1,230.00	1,512.90	1,860.87	4,603.77	1,722.00	1,739.22	1,756.61	5,217.83	1,600.08	2,368.12	3,
5	Jazz	1,575.00	1,937.25	2,382.82	5,895.07	2,205.00	2,227.05	2,249.32	6,681.37	2,048.89	3,032.35	4,
6	Classical	560.00	688.80	847.22	2,096.02	784.00	791.84	799.76	2,375.60	728.49	1,078.17	1,
7	Other	899.00	1,105.77	1,360.10	3,364.87	1,258.60	1,271.19	1,283.90	3,813.68	1,169.49	1,730.85	2,
8	Total Download Sales	4,264.00	5,244.72	6,451.01	15,959.73	5,969.60	6,029.30	6,089.59	18,088.48	5,546.95	8,209.49	12,
9	Compact Discs											

FIGURE 4-11: Use Excel's View Side by Side command to compare data stored on two different sheets in the same workbook. (Sample workbook: CG Music 2020 – 2022 Sales.xlsx)

Here are the steps I followed to create and arrange these windows in the `CG Music 2020 – 2022 Sales.xlsx` workbook:

1. **Open the workbook file for editing and then create a new window by clicking the View tab's New Window command (it's in the Window group), or by pressing Alt+WN.**

   Excel appends the number 2 to the workbook's filename displayed at the top of the screen (as in `CG`

`Music 2020 – 2022 Sales.xlsx – 2)` to indicate that a new window has been added to the workbook.

2. **In the View tab's Window group, click the View Side by Side command (the one with the icon that shows two pages side by side), or press Alt+WB.**

   Excel displays the Compare Side by Side dialog box.

   Note that you only see this dialog box if you have at least one other Excel window open. If you just have the two windows of your workbook open, Excel arranges the two windows one on top of the other, so you can skip the rest of these steps.

3. **In the Compare Side by Side With list, click the other workbook window.**
4. **Click OK to arrange the two workbook windows one on top of the other, as shown in Figure 4-11.**

REMEMBER You can switch between open workbook windows by clicking the View tab's Switch Windows button followed by the name of the window you want to activate.

Immediately below the View Side by Side command button in the Windows group on the View tab of the Ribbon, you find these two command buttons:

- **Synchronous Scrolling:** When you select this button, any scrolling that you do in the worksheet in the active window is mirrored and synchronized in the worksheet in the inactive window beneath it. To scroll the worksheet in the active window independently of the inactive window, deactivate the Synchronous Scrolling button.
- **Reset Window Position:** Click this button if you manually resize the active window (by dragging its size box) and then want to restore the two windows to their previous side-by-side arrangement.

To remove the side-by-side windows, click the View tab's View Side by Side command button again or press Alt+WB. Excel returns the windows to the display arrangement (see “Window arrangements” that follows for details) that you were using before clicking the View Side by Side command the first time. If you haven't previously selected a display option in the Arrange Windows dialog box, Excel displays the active window full size.

Note, too, that you can use Excel's View Side by Side feature to compare worksheets in different workbooks just as well as different sheets in the same workbook. (See “Comparing windows on different workbooks” later in this chapter.)

Window arrangements

After creating one or more additional windows for a workbook (by clicking the View tab's New Window command), you can then vary their arrangement by clicking the View tab's Arrange All button (or by pressing Alt+WA) to open the Arrange Windows dialog box. The Arrange Windows dialog box contains the following four options:

- **Tiled:** Excel arranges and sizes the windows so that they all fit side by side on the screen in the order in which you open them (when only two windows are open, selecting the Tiled or Vertical option results in the same side-by-side arrangement).
- **Horizontal:** Excel sizes the windows equally and then arranges them one above the other (this is the default arrangement option that Excel uses when you click the View Side by Side command button).
- **Vertical:** Excel sizes the windows equally and then arranges them next to one other, vertically from left to right.
- **Cascade:** Excel arranges and sizes the windows so that they overlap one another with only their title bars visible.

To ensure that Excel arranges only the windows you have open for your workbook, select the Windows of Active Workbook check box and click OK.

After arranging your windows, you can then select different sheets to display in either window by clicking their sheet tabs, and you can select different parts of the sheet to display by using the window’s scroll bars.

TIP

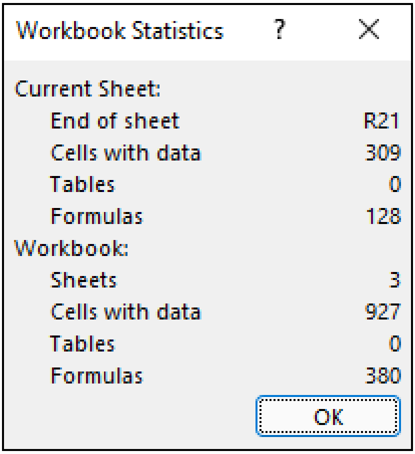
To activate different windows on the workbook so that you can activate a different worksheet by selecting its sheet tab and/or use the scroll bars to bring new data into view, click the window’s title bar or press Ctrl+F6 until its title bar is selected.

When you want to resume normal, fullscreen viewing in the workbook window, click the Maximize button in one of the windows. To get rid of a second window, click its button on the taskbar and then click its Close Window button on the far-right side of the menu bar (the one with the X). (Be sure that you don’t click the Close button on the far-right of the Excel title bar, because doing this closes your workbook file and exits you from Excel!)

Viewing workbook stats

After you've spent some time building an impressive workbook model, you may start asking yourself some questions: How many tables am I using? How many formulas have I created? What is the last cell on the current worksheet? Well, okay, maybe you've never even thought to ask these questions. That's fine. The good news is that, just in case curiosity strikes, the answers are a few of clicks away.

Excel displays stats for both the entire workbook and the current worksheet, so begin by selecting the worksheet you want to see statistics for. Click the Review tab and then, in the Proofing group, click Workbook statistics. Excel opens the Workbook Statistics dialog box, which is similar to the one shown in Figure 4-12.



Current Sheet:

End of sheet	R21
Cells with data	309
Tables	0
Formulas	128

Workbook:

Sheets	3
Cells with data	927
Tables	0
Formulas	380

FIGURE 4-12: The Workbook Statistics command tells you a few vital statistics for your current worksheet and the entire workbook.

Working with Multiple Workbooks

Working with more than one worksheet in a single workbook is bad enough but working with worksheets in different workbooks can be really wicked. The key to doing this successfully is just keeping track of "who's on first"; you do this by opening and using windows on the individual workbook files you have open.

With the different workbook windows in place, you can then compare the data in different workbooks, use the drag-and-drop method to copy or move data between workbooks, or even copy or move entire worksheets.

Comparing windows on different workbooks

To work with sheets from different workbook files you have open, you manually arrange their workbook windows in the Excel work area, or you click the View tab's View Side by Side command (or press Alt +WB). If you have only two workbooks open when you do this, Excel places the active workbook that you last opened above the one that opened earlier (with their active worksheets displayed). If you have more than two workbooks open, Excel displays the Compare Side by Side dialog box where you click the name of the workbook that you want to compare with the active one and then click OK.

REMEMBER If you need to compare more than two workbooks on the same screen, instead of clicking the View tab's View Side by Side button, you click the View tab's Arrange All button and then select the desired Arrange option (Tiled, Horizontal, Vertical, or Cascading) in the Arrange Windows dialog box. Just make sure when selecting this option that the Windows of Active Workbook check box is *not* selected in the Arrange Windows dialog box.

Transferring data between open windows

After you arrange the windows on your different workbooks the way you want them, you can compare or transfer information between the windows. To compare data in different workbooks, you switch between the different windows, activating and bringing the regions of the different worksheets you want to compare into view.

To move data between workbook windows, arrange the worksheets in these windows so that both the cells with the data entries you want to move and the cell range into which you want to move them are both displayed in their respective windows. Select the range you want to move, drag it to the other worksheet window, drag it to the first cell of the destination range, and release the mouse button. To copy data between workbooks, you follow the same steps, except that you hold down the Ctrl key as you drag the selected range from one window to another. (See Book 2, Chapter 3 for information on using drag-and-drop to copy and move data entries.)

TIP When you're finished working with workbook windows arranged in some manner, you can return to the normal full-screen view by clicking the Maximize button on one of the windows. As soon as you maximize one workbook window, all the rest of the arranged workbook windows are made full size as well. If you used the View Side by Side feature to set up the windows, you can do this by clicking the View tab's View Side by Side command button again or by pressing Alt+WB.

Moving or copying sheets from one

workbook to another

Instead of copying cell ranges from one workbook to another, you can move (or copy) entire worksheets between workbooks. You can do this with drag-and-drop or by choosing the Move or Copy Sheet option from the Format command button’s drop-down menu on the Ribbon’s Home tab.

To use drag-and-drop to move a sheet between open windows, you drag its sheet tab from its window to the place on the sheet tabs in the other window. When you release the mouse button, the entire worksheet is moved from one file to the other, and its sheet tab now appears among the others in that workbook. To copy a sheet rather than move it, you perform the same steps, except that you hold down the Ctrl key as you drag the sheet tab from one window to the next.

To use the Move or Copy Sheet option on the Format command button’s drop-down menu to move or copy entire worksheets, you follow these steps:

1. **Open both the workbook containing the sheets to be moved or copied and the workbook where the sheets will be moved or copied to.**

   Both the source and destination workbooks must be open to copy or move sheets between them.

2. **Click the workbook window with sheets to be moved or copied.**

   Doing this activates the source workbook so that you can select the sheet or sheets you want to move or copy.

3. **Select the sheet tab of the worksheet or worksheets to be moved or copied.**

   To select more than one worksheet, hold down the Ctrl key as you click the individual sheet tabs.

4. **In the Home tab's Cells group, click the Format button and then choose Move or Copy Sheet (or press Alt+HOM).**

   Excel opens the Move or Copy dialog box.

5. **From the To Book drop-down menu, choose the filename of the workbook into which the selected sheets are to be moved or copied.**

   If you want to move or copy the selected worksheets into a new workbook file, click the (New Book) item at the very top of this drop-down menu.

6. **In the Before Sheet list box, click the name of the sheet that should immediately follow the sheet(s) that you're about to move or copy into this workbook.**

   If you want to move or copy the selected sheet(s) to the very end of the destination workbook, click (Move to End) at the bottom of this list box.

7. **If you want to copy the selected sheet(s) rather than move them, click the Create a Copy check box.**

   If you don't click this check box, Excel automatically moves the selected sheet(s) from one workbook to the other instead of copying them.

8. **Click OK to close the Move or Copy dialog box and complete the move or copy operation.**

Consolidating Worksheets

Excel allows you to consolidate data from different worksheets into a single worksheet. Using the program's Consolidate command button on the Data tab of the Ribbon, you can easily combine data from multiple worksheets. For example, you can use the Consolidate command to total all budget worksheets prepared by each department in the company or to create summary totals for income statements for a period of several years. If you used a template to create each worksheet you're consolidating, or an identical layout, Excel can quickly consolidate the values by virtue of their common position in their respective worksheets. However, even when the data entries are laid out differently in each worksheet, Excel can still consolidate them provided that you've used the same labels to describe the data entries in their respective worksheets.

Most of the time, you want to total the data that you're consolidating from the worksheets. By default, Excel uses the SUM function to total all the cells in the worksheets that share the same cell references (when you consolidate by position) or that use the same labels (when you consolidate by category). You can, however, have Excel use any of the other following statistical functions when doing a consolidation: AVERAGE, COUNT, COUNTA, MAX, MIN, PRODUCT, STDEV, STDEVP, VAR, or VARP. (See Book 3, Chapter 5 for more information on these functions.)

To begin consolidating the sheets in the same workbook, you select a new worksheet to hold the consolidated data. (If need be, insert a new sheet in the workbook by clicking the Insert Worksheet button.) To begin consolidating sheets in different workbooks, open a new workbook. If the sheets in the workbooks are generated from a template, open the new workbook for the consolidated data from that template.

Before you begin the consolidation process on the new worksheet, you choose the cell or cell range in this worksheet where the consolidated data is to appear. (This range is called the *destination area.*) If you select a single cell, Excel expands the destination area to columns to the right and rows below as needed to accommodate the consolidated data. If you select a single row, the program expands the destination area down subsequent rows of the worksheet, if required to accommodate the data. If you select a single column, Excel expands the destination area across columns to the right, if required to accommodate the data. If, however, you select a multi-cell range as the destination area, the program does not expand the destination area and restricts the consolidated data just to the cell selection.

TIP If you want Excel to use a particular range in the worksheet for all consolidations you perform in a worksheet, assign the range name Consolidate_Area to this cell range. Excel then consolidates data into this range whenever you use the Consolidate command.

When consolidating data, you can select data in sheets in workbooks that you've opened in Excel or in sheets in unopened workbooks stored on disk. The cells that you specify for consolidation are referred to as the *source area,* and the worksheets that contain the source areas are known as the *source worksheets.*

If the source worksheets are open in Excel, you can specify the references of the source areas by pointing to the cell references (even when the Consolidate dialog box is open, Excel allows you to activate different worksheets and scroll through them as you select the cell references for the source area). If the source worksheets are not open in Excel, you must type in the cell references as external references, following the same guidelines you use when typing a linking formula with an external reference (except that you don’t type =). For example, to specify the data in range B4:R21 on Sheet1 in a workbook named `CG Music - 2022 Sales.xlsx` as a source area, you enter the following external reference:

```
'[CG Music - 2022 Sales.xlsx]Sheet1'!$b$4:$r$21
```

Note that if you want to consolidate the same data range in all the worksheets that use a similar filename (for example, `CG Music - 2020 Sales`, `CG Music - 2021 Sales`, `CG Music - 2022 Sales`, and so on), you can use the asterisk (*) or the question mark (?) as wildcard characters to stand for missing characters as in

```
'[CG Music - 20?? Sales.xlsx]Sheet1'!$B$4:$R$21
```

In this example, Excel consolidates the range A2:R21 in Sheet1 of all versions of the workbooks that use “CG - Music - 20” in the main file when this name is followed by another two characters (be they 20, 21, 22, and so on).

When you consolidate data, Excel uses only the cells in the source areas that contain values. If the cells contain formulas, Excel uses their calculated values, but if the cells contain text, Excel ignores them and treats them as though they were blank. (Except in the case of category labels when you're consolidating your data by category as described later in this chapter.)

Consolidating by position

You consolidate worksheets by position when they use the same layout (such as those created from a template). When you consolidate data by position, Excel does not copy the labels from the source areas to the destination area, only values. To consolidate worksheets by position, you follow these steps:

1. **Open all the workbooks with the worksheets you**

want to consolidate. If the sheets are all in one workbook, open it in Excel.

Now you need to activate a new worksheet to hold the consolidated data. If you're consolidating the data in a new workbook, you need to open it (File⇒ New or Alt+FN). If you’re consolidating worksheets generated from a template, use the template to create the new workbook in which you are to consolidate the worksheet data.

2. **Click the New Sheet button to open a new worksheet to hold the consolidated data.**

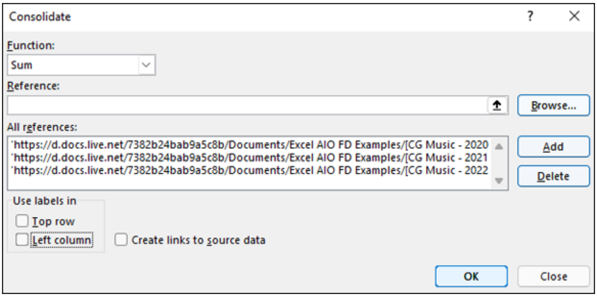
   Next, you need to select the destination area in the new worksheet that is to hold the consolidated data.

3. **Click the cell at the beginning of the destination area in the consolidation worksheet or select the cell range if you want to limit the destination area to a particular region.**

   If you want Excel to expand the size of the destination area as needed to accommodate the source areas, just select the first cell of this range.

4. **In the Data tab's Data Tools group, click the Consolidate command (or press Alt+AN).**

   Excel opens the Consolidate dialog box, shown in Figure 4-13. By default, Excel uses the SUM function to total the values in the source areas. If you want to use another statistical function such as AVERAGE or COUNT, select the desired function from the Function drop-down list box.



Function: Sum

Reference:

All references:
'https://d.docs.live.net/7382b24bab9a5c8b/Documents/Excel AIO FD Examples/[CG Music - 2020
'https://d.docs.live.net/7382b24bab9a5c8b/Documents/Excel AIO FD Examples/[CG Music - 2021
'https://d.docs.live.net/7382b24bab9a5c8b/Documents/Excel AIO FD Examples/[CG Music - 2022

Use labels in
☐ Top row
☐ Left column
☐ Create links to source data

FIGURE 4-13: Using the Consolidate dialog box to total sales data for three years stored on separate worksheets.

5. **(Optional) Select the function you want to use from the Function drop-down list box if you don't want the values in the source areas summed together.**

   Now, you need to specify the source ranges to be consolidated and add them to the All References list box in the Consolidate dialog box. To do this, you specify each range to be used as the source data in the Reference text box and then click the Add button to add it to the All References list box.

6. **Select the cell range or type the cell references for the first source area in the Reference text box.**

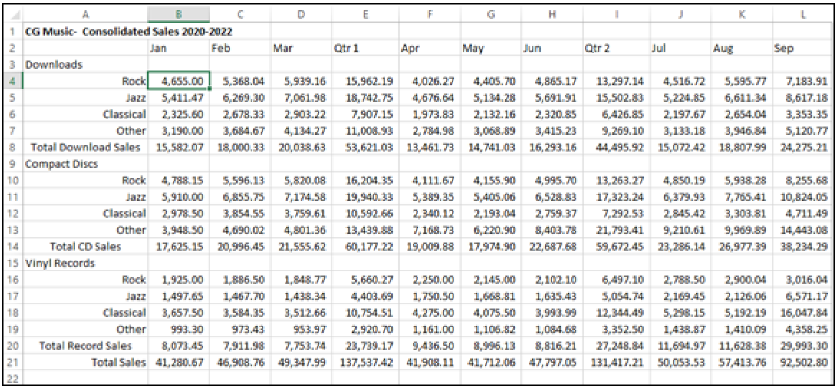
   When you select the cell range by pointing, Excel minimizes the Consolidate dialog box to the Reference text box so that you can see what you're selecting. If the workbook window is not visible, choose it from the Switch Windows button on the View tab or the Windows taskbar and then select the cell selection as you normally would. (Remember that you can move the Consolidate dialog box minimized to the Reference text box by dragging it by the title bar.)

   If the source worksheets are not open, you can click the Browse command button to select the filename in the Browse dialog box to enter it (plus an exclamation point) into the Reference text box, and then you can type in the range name or cell references you want to use. If you prefer, you can type in the entire cell reference including the filename. Remember that you can use the asterisk (*) and question mark (?) wildcard characters when typing in the references for the source area.

7. **Click the Add button to add this reference to the first source area to the All References list box.**
8. **Repeat Steps 6 and 7 until you have added all the references for all the source areas that you want to consolidate.**
9. **Click OK in the Consolidate dialog box.**

   Excel closes the Consolidate dialog box and then consolidates all the values in the source areas in the place in the active worksheet designated as the destination area. Note that you can click the Undo button on the Quick Access toolbar or press Ctrl+Z to undo the effects of a consolidation if you find that you defined the destination and/or the source areas incorrectly.

Figure 4-14 shows you the first part of a consolidation for three years (2020, 2021, and 2022) of record store sales in the newly created `CG Music 2020 – 2022 Consolidated Sales.xlsx` file in the workbook window in the upper-left corner. The Consolidated worksheet in this file totals the source area B4:R21 from the Sales worksheets in the `CG Music – 2020 Sales.xlsx` workbook with the 2020 annual sales, the `CG Music – 2021 Sales.xlsx` workbook with the 2021 annual sales, and the `CG Music – 2022 Sales.xlsx` workbook with the 2022 annual sales. These sales figures are consolidated in the destination area, B4:R21, in the Consolidated sheet in the `CG Music 2020 – 2022 Consolidated Sales.xls` workbook. (However, because all these worksheets use the same layout, only cell B4, the first cell in this range, was designated at the destination area.)



	A	B	C	D	E	F	G	H	I	J	K	L
1	CG Music- Consolidated Sales 2020-2022											
2		Jan	Feb	Mar	Qtr 1	Apr	May	Jun	Qtr 2	Jul	Aug	Sep
3	Downloads											
4	Rock	4,655.00	5,368.04	5,939.16	15,962.19	4,026.27	4,405.70	4,865.17	13,297.14	4,516.72	5,595.77	7,183.91
5	Jazz	5,411.47	6,269.30	7,061.98	18,742.75	4,676.64	5,134.28	5,691.91	15,502.83	5,224.85	6,611.34	8,617.18
6	Classical	2,325.60	2,678.33	2,903.22	7,907.15	1,973.83	2,132.16	2,320.85	6,426.85	2,197.67	2,654.04	3,353.35
7	Other	3,190.00	3,684.67	4,134.27	11,008.93	2,784.98	3,068.89	3,415.23	9,269.10	3,133.18	3,946.84	5,120.77
8	Total Download Sales	15,582.07	18,000.33	20,038.63	53,621.03	13,461.73	14,741.03	16,293.16	44,495.92	15,072.42	18,807.99	24,275.21
9	Compact Discs											
10	Rock	4,788.15	5,596.13	5,820.08	16,204.35	4,111.67	4,155.90	4,995.70	13,263.27	4,850.19	5,938.28	8,255.68
11	Jazz	5,910.00	6,855.75	7,174.58	19,940.33	5,389.35	5,405.06	6,528.83	17,323.24	6,379.93	7,765.41	10,824.05
12	Classical	2,978.50	3,854.55	3,759.61	10,592.66	2,340.12	2,193.04	2,759.37	7,292.53	2,845.42	3,303.81	4,711.49
13	Other	3,948.50	4,690.02	4,801.36	13,439.88	7,168.73	6,220.90	8,403.78	21,793.41	9,210.61	9,969.89	14,443.08
14	Total CD Sales	17,625.15	20,996.45	21,555.62	60,177.22	19,009.88	17,974.90	22,687.68	59,672.45	23,286.14	26,977.39	38,234.29
15	Vinyl Records											
16	Rock	1,925.00	1,886.50	1,848.77	5,660.27	2,250.00	2,145.00	2,102.10	6,497.10	2,788.50	2,900.04	3,016.04
17	Jazz	1,497.65	1,467.70	1,438.34	4,403.69	1,750.50	1,668.81	1,635.43	5,054.74	2,169.45	2,126.06	6,571.17
18	Classical	3,657.50	3,584.35	3,512.66	10,754.51	4,275.00	4,075.50	3,993.99	12,344.49	5,298.15	5,192.19	16,047.84
19	Other	993.30	973.43	953.97	2,920.70	1,161.00	1,106.82	1,084.68	3,352.50	1,438.87	1,410.09	4,358.25
20	Total Record Sales	8,073.45	7,911.98	7,753.74	23,739.17	9,436.50	8,996.13	8,816.21	27,248.84	11,694.97	11,628.38	29,993.30
21	Total Sales	41,280.67	46,908.76	49,347.99	137,537.42	41,908.11	41,712.06	47,797.05	131,417.21	50,053.53	57,413.76	92,502.80
22												

FIGURE 4-14: The Consolidated worksheet after having Excel total sales from the last three years.

TIP

Excel allows only one consolidation per worksheet at one time. You can, however, add to or remove source areas and repeat a consolidation. To add new source areas, open the Consolidate dialog box and then specify the cell references in the Reference text box and click the Add button. To remove a source area, click its references in the All References list box and then click the Delete button. To perform the consolidation with the new source areas, click OK. To perform a second consolidation in the same worksheet, choose a new destination area, open the Consolidate dialog box, clear all the source areas you don't want to use in the All References list box with the Delete button, and then redefine all the new source areas in the Reference text box with the Add button before you perform the consolidation by clicking the OK button.

Consolidating by category

You consolidate worksheets by category when their source areas do not share the same cell coordinates in their respective worksheets, but their data entries do use common column and/or row labels. When you consolidate by category, you include these identifying labels as part of the source areas. Unlike when consolidating by position, Excel copies the row labels and/or column labels when you specify that they should be used in the consolidation.

When consolidating worksheet data by category, you must specify whether to use the top row of column labels and/or the left column of row labels in determining which data to consolidate. To use the top row of column labels, select the Top Row check box in the Use Labels In section of the Consolidate dialog box. To use the left column of row labels, select the Left Column check box in this area. Then, after you've specified all the source areas (including the cells that contain these column and row labels), you perform the consolidation in the destination area by clicking the Consolidate dialog box's OK button.

Linking consolidated data

Excel allows you to link the data in the source areas to the destination area during a consolidation. That way, any changes that you make to the values in the source area are automatically updated in the destination area of the consolidation worksheet. To create links between the source worksheets and the destination worksheet, select the Create Links to Source Data check box in the Consolidate dialog box when defining the settings for the upcoming consolidation.

When you perform a consolidation with linking, Excel creates the links between the source areas and the destination area by outlining the destination area. (See "Outlining worksheets" earlier in this chapter for details.) Each outline level created in the destination area holds rows or columns that contain the linking formulas to the consolidated data.

Chapter 5

Printing Worksheets

IN THIS CHAPTER

- **Previewing pages and printing from the Excel Backstage view**
- **Quick Printing from the Quick Access toolbar**
- **Printing all the worksheets in a workbook**
- **Printing just some of the cells in a worksheet**
- **Changing page orientation**
- **Printing the whole worksheet on a single page**
- **Changing margins for a report**
- **Adding a header and footer to a report**
- **Printing column and row headings as print titles on every page**
- **Inserting page breaks in a report**
- **Printing the formulas in your worksheet**

You probably won't print your worksheets all that often, but for those times when you need to hand out one or more worksheets at a meeting or presentation, Excel gives you the tools to produce professional-looking reports. This chapter covers how to select the printer that you want to use; print all or just selected parts of the worksheet; change your page layout and print settings, including the orientation, paper size, print quality, number of copies, and range of pages, all from the Excel Backstage view. The chapter also enlightens you on how to use the Ribbon to set up reports using the correct margin settings, headers and footers, titles, and page breaks; and use the Page Layout, Print Preview, and Page Break Preview features to make sure that the pages of your report are the way you want them to appear before you print them.

The printing techniques covered in this chapter focus primarily on printing the data in your worksheets. However, in Excel you can also print your charts in chart sheets. Not surprisingly, you'll find that most of the printing techniques that you learn for printing worksheet data in this chapter also apply to printing charts in their respective sheets. (For specific information on printing charts, see Book 5, Chapter 1.)

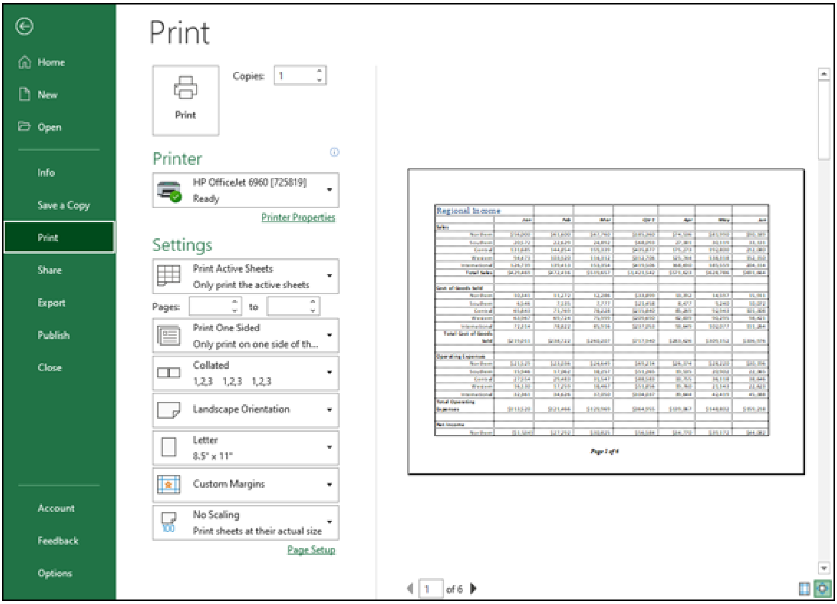
Printing from the Backstage View

The Backstage view contains a Print screen (shown in Figure 5-1; sample workbook: Income Analysis.xlsx) opened by choosing File ⇒ Print or pressing Ctrl + P. This Print screen enables you to do any of the following:

- Change the number of copies to be printed by entering a new value in the Copies combo box.
- Click the name of a new printer to use in printing the worksheet report from the Printer drop-down list box. (See “Selecting the printer to use” that follows for details.)
- Change what part of the worksheet is printed in the report by selecting a new preset in the first drop-down list under Settings. You can choose between Print Active Sheets (the default), Print Entire Workbook, or Print Selection — or by entering a new value in the Pages combo boxes immediately below. Click the Ignore Print Area option when you want one of the other Print What options (Active Sheets, Entire Workbook, or Selection) that you selected to be used in the printing rather than the Print Area you previously defined. (See the “Setting and clearing the Print Area” section later in this chapter for details on how to set this area.)
- Print on both sides of the paper (assuming that your printer is capable of double-sided printing) by opening the second drop-down list under Settings and then clicking either the Print on Both Sides, Flip Pages on Long Edge option, or the Print on Both Sides, Flip Pages on Short Edge option.
- Print multiple copies of the worksheet report without having your printer collate the pages of each copy (collating the copies is the default) by opening the third drop-down list under Settings and then clicking the Uncollated option.
- Change the orientation of the printing on the paper from the

default portrait orientation to landscape (so that more columns of data and fewer rows are printed on each page of the report) by opening the fourth drop-down list under Settings and then clicking the Landscape Orientation option.

- Change the paper size from Letter (8.5 x 11 in) to another paper size supported by your printer by opening the fifth drop-down list under Settings and then selecting a paper size option.
- Change the margins from the default Normal margins to Wide, Narrow, or the Last Custom Setting (representing the margin settings you last manually set for the report) by opening the sixth drop-down list under Settings and then selecting one of these presets. (See "Massaging the margins" later in this chapter for details.)
- Scale the worksheet so that all its columns or all its rows or all of its columns and rows fit onto a single printed page by opening the seventh (and final) drop-down list under Settings and then selecting a preset.
- Change the default settings used by your printer by using the options in the particular printer's Options dialog box. (These settings can include the print quality and color versus black and white or grayscale, depending upon the type of printer.) Open it by clicking the Printer Properties link right under the name of your printer in the Print screen.
- Preview the pages of the worksheet report on the right side of the Print screen. (See "Previewing the printout" later in this chapter for details.)


Home
New
Open
Info
Save a Copy
Print
Share
Export
Publish
Close
Account
Feedback
Options
Print
Print
Printer Properties
Page Setup
of 6

Copies: 1

Printer
HP OfficeJet 6960 [725819]
Ready

Settings
Print Active Sheets
Only print the active sheets
Pages: to
Print One Sided
Only print on one side of th...
Collated
1,2,3 1,2,3 1,2,3
Landscape Orientation
Letter
8.5" x 11"
Custom Margins
No Scaling
Print sheets at their actual size

FIGURE 5-1: You can use the Print screen in the Backstage view to customize your worksheet reports. (Sample workbook: Income Analysis.xlsx)

Selecting the printer to use

Windows allows you to install more than one printer for use with your applications. If you've installed multiple printers, the first one installed becomes the default printer, which is used by all Windows applications, including Excel. If you get a new printer, you must first install it from the Windows' Settings app before you can select and use the printer in Excel.

To select a new printer to use in printing the current worksheet, follow these steps:

1. **Open the workbook with the worksheet that you want to print and activate that worksheet.**
2. **Choose File ⇒ Print or press Ctrl + P.**

   The Print screen opens in the Backstage view (similar to the one shown in Figure 5-1).
3. **In the Printer drop-down list, select the name of the new printer that you want to use.**

   If the printer that you want to use isn't listed in the drop-down list, you can try to add the printer with the Add Printer link near the bottom of the list. When you click this button, Excel opens the Settings app and displays the Printers & Scanners screen where you then click Add Device to install the printer that you want to use. Note that if you don't have a printer connected to your computer, clicking the Find Printer button and opening the Find Printers dialog box results in opening a Find in the Directory alert dialog box with the message, "The Active Directory Domain Services is Currently Unavailable." When you click OK in this alert dialog box, Excel closes it as well as the Find Printers dialog box.

4. **To change any of the default settings for the printer that you've selected, click the Printer Properties link and then select the new settings in the Properties dialog box for the printer that you selected.**
5. **Make any other required changes using the options (Pages, Collated, and so on) in the Settings section of the Print screen.**
6. **Click the Print button near the top of the left side of the Print screen to print the specified worksheet data using the newly selected printer.**

Keep in mind that the printer you select and use in printing the current worksheet remains the selected printer in Excel until you change back to the original printer (or some other printer).

Previewing the printout

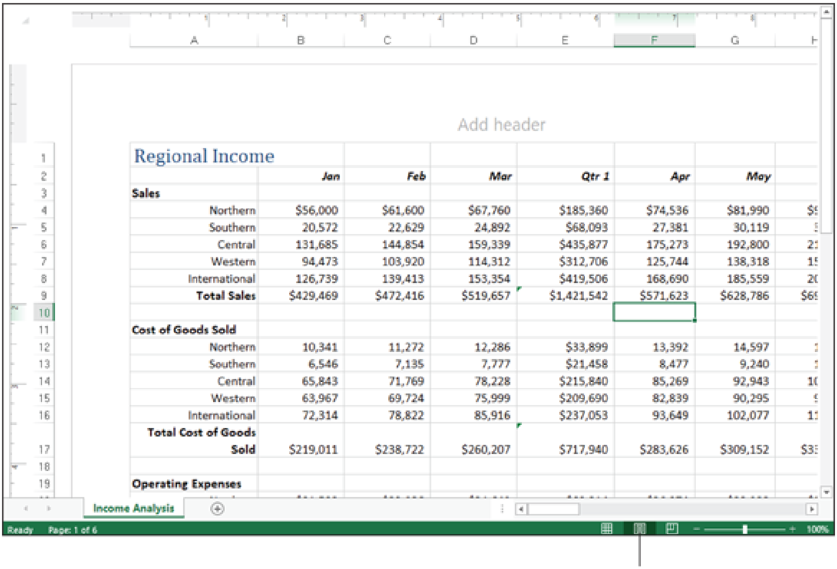
Excel gives you two ways to check the page layout before you send the report to the printer. In the worksheet, you can use the Page Layout view in the regular worksheet window that shows all the pages plus the margins along with the worksheet and row headings and rulers. Or, in the Excel Backstage view, you can use the old standby Print Preview on the right side of the Print screen, which shows you the pages of the report more or less as they appear on the printed page.

Checking the paging in Page Layout view

Excel's Page Layout view gives you instant access to the paging of the active worksheet. To switch to Page Layout view, Excel gives you two choices:

- Display the View tab; then, in the Workbook Views group, click Page Layout.
- In the Status bar, click the Page Layout View icon, pointed out in Figure 5-2.

As you can see in Figure 5-2 (sample workbook: Income Analysis.xlsx), when you switch to Page Layout view, Excel adds horizontal and vertical rulers to the column letter and row number headings. In the worksheet area, this view shows the margins for each printed page with any headers and footers defined for the report along with the breaks between each. (Often you have to use the Zoom slider to reduce the screen magnification to display the page breaks on the screen.)



Regional Income						
	Jan	**Feb**	**Mar**	**Qtr 1**	**Apr**	**May**
Sales						
Northern	$56,000	$61,600	$67,760	$185,360	$74,536	$81,990
Southern	20,572	22,629	24,892	$68,093	27,381	30,119
Central	131,685	144,854	159,339	$435,877	175,273	192,800
Western	94,473	103,920	114,312	$312,706	125,744	138,318
International	126,739	139,413	153,354	$419,506	168,690	185,559
Total Sales	$429,469	$472,416	$519,657	$1,421,542	$571,623	$628,786
Cost of Goods Sold						
Northern	10,341	11,272	12,286	$33,899	13,392	14,597
Southern	6,546	7,135	7,777	$21,458	8,477	9,240
Central	65,843	71,769	78,228	$215,840	85,269	92,943
Western	63,967	69,724	75,999	$209,690	82,839	90,295
International	72,314	78,822	85,916	$237,053	93,649	102,077
Total Cost of Goods Sold	$219,011	$238,722	$260,207	$717,940	$283,626	$309,152
Operating Expenses						

Page Layout View

FIGURE 5-2: Viewing a worksheet in Page Layout view. (Sample workbook: Income Analysis.xlsx)

TIP To see all the pages required to print the active worksheet, drag the slider button in the Zoom slider on the Status bar to the left until you decrease the screen magnification sufficiently to display all the pages of data.

REMEMBER Excel displays rulers using the default units for your computer (inches on a United States computer and centimeters on a Canadian or European machine). To change the units, open the Advanced tab of the Excel Options dialog box (File ⇒ Options ⇒ Advanced or Alt + FTA) and then choose the appropriate unit from the Ruler Units drop-down menu (Inches, Centimeters, or Millimeters) in the Display section. You can turn the rulers off and back on in Page Layout view by deselecting the View tab's Ruler check box (it's in the Show group) or by pressing Alt + WR.

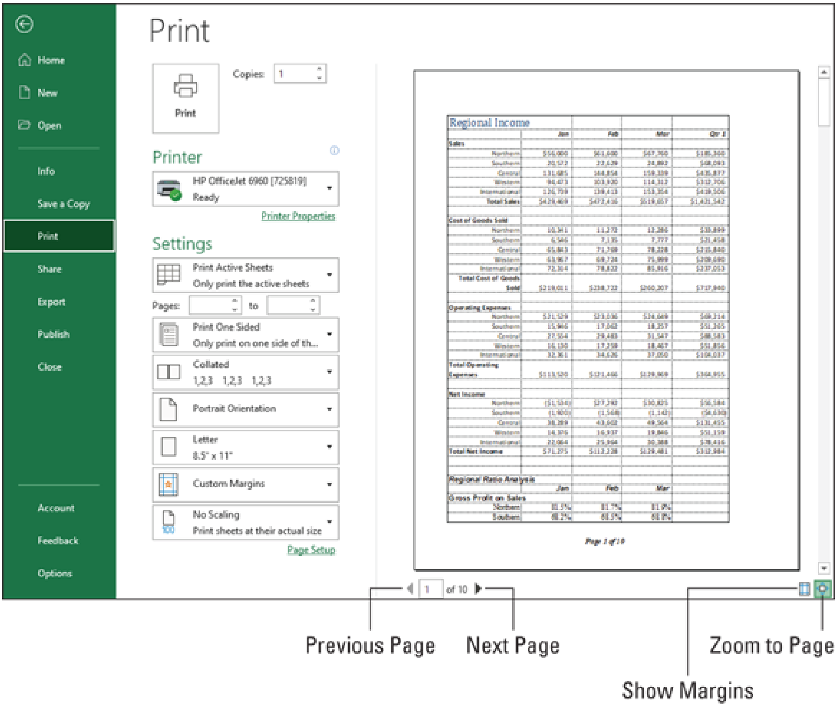
Previewing the pages of the report

Stop wasting paper and save your sanity by using the Print Preview feature before you print any worksheet, section of a worksheet, or entire workbook. Because of the peculiarities in paging worksheet data, check the page breaks for any report that requires more than one page. You can use Print Preview in the Print screen of the Excel Backstage view to see exactly how the worksheet data will be paged when printed. That way, you can return to the worksheet and make any necessary last-minute changes to the data or page settings before sending the report on to the printer.

To switch to the Print screen and preview the printout, choose File ⇒ Print or press Ctrl + P. Excel displays the first page of the report on the right side of the Print screen. Look at Figure 5-3 (sample workbook: Income Analysis.xlsx) to see the first preview page of a ten-page report as it initially appears in the Print screen.

When Excel displays a full page in the Print Preview window, you sometimes can barely read its contents. In such a case, you can increase the view to actual size when you need to verify specific regions of the worksheet by clicking the Zoom to Page button (pointed out in Figure 5-3). Check out the difference in Figure 5-4 (sample workbook: Income Analysis.xlsx) — here you can see what the first page of the ten-page report looks like after I zoom in by clicking the Zoom to Page button.

After you enlarge a page to actual size, use the scroll bars to bring new parts of the page into view in the Print Preview window. To return to the full-page view, you deselect the Zoom to Page button by clicking it a second time.


Home
New
Open
Info
Save a Copy
Print
Share
Export
Publish
Close
Account
Feedback
Options
Previous Page
Next Page
Zoom to Page
Show Margins

Print

Copies: 1

Printer

HP OfficeJet 6960 [725819]
Ready

Printer Properties

Settings

Print Active Sheets
Only print the active sheets

Pages: to

Print One Sided
Only print on one side of th...

Collated
1,2,3 1,2,3 1,2,3

Portrait Orientation

Letter
8.5" x 11"

Custom Margins

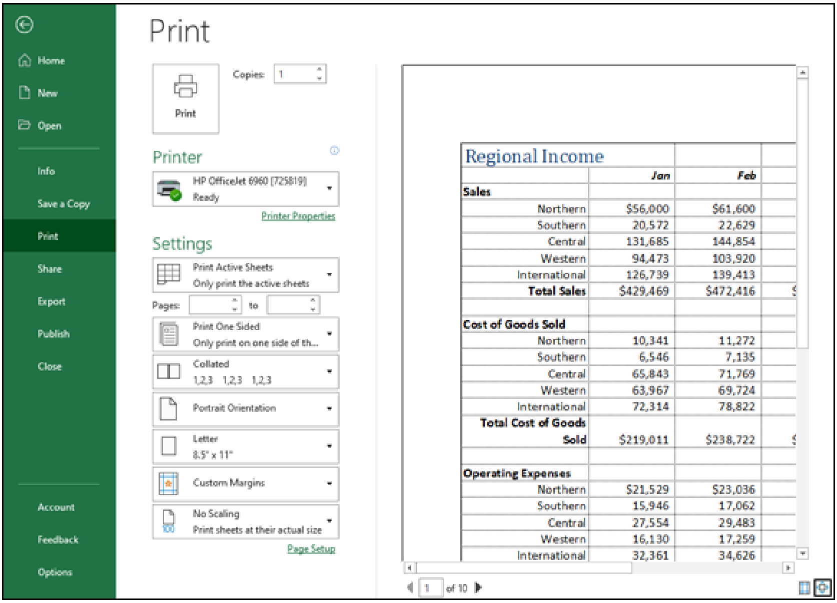
No Scaling
Print sheets at their actual size

Page Setup

Page 1 of 10

1 of 10

FIGURE 5-3: Page 1 of a ten-page report in Print Preview. (Sample workbook: Income Analysis.xlsx)


Home
New
Open
Info
Save a Copy
Print
Share
Export
Publish
Close
Account
Feedback
Options

Print

Copies: 1

Printer

HP OfficeJet 6960 [725819]
Ready

Printer Properties

Settings

Print Active Sheets
Only print the active sheets

Pages: to

Print One Sided
Only print on one side of th...

Collated
1,2,3 1,2,3 1,2,3

Portrait Orientation

Letter
8.5" x 11"

Custom Margins

No Scaling
Print sheets at their actual size

Page Setup

Regional Income		
	Jan	Feb
Sales		
Northern	$56,000	$61,600
Southern	20,572	22,629
Central	131,685	144,854
Western	94,473	103,920
International	126,739	139,413
Total Sales	$429,469	$472,416
Cost of Goods Sold		
Northern	10,341	11,272
Southern	6,546	7,135
Central	65,843	71,769
Western	63,967	69,724
International	72,314	78,822
Total Cost of Goods Sold	$219,011	$238,722
Operating Expenses		
Northern	$21,529	$23,036
Southern	15,946	17,062
Central	27,554	29,483
Western	16,130	17,259
International	32,361	34,626

1 of 10

FIGURE 5-4: Page 1 of a ten-page report after selecting the Zoom to Page button. (Sample workbook: Income Analysis.xlsx)

Excel indicates the number of pages in a report at the bottom left of the Print Preview area. If your report has more than one page, view pages that follow by clicking the Next Page button (pointed out in Figure 5-3). To review a page you've already seen, back up a page by clicking the Previous Page button (also pointed out in Figure 5-3). (The Previous Page button is grayed out if you're on the first page.) You can also advance to a particular page in the report by typing its page number into the text box to the immediate right of the Previous Page button that shows the current page and then pressing Enter.

If you want to display the current margin settings for the report in the print preview area, click the Show Margins button (pointed out in Figure 5-3). After the margins are displayed, you can then manually manipulate them by dragging them to new positions. (See "Massaging the margins" later in this chapter for details.)

When you finish previewing the report, you can print the worksheet report by clicking the Print button in the Print screen or you can exit the Backstage view and return to the worksheet by clicking the Back button at the very top of the File menu along the left side of the screen.

Quick Printing the Worksheet

If you want to use Excel's default print settings to print all the cells in the current worksheet, printing in Excel becomes a one-click exercise. To get that convenience, display the Quick Access toolbar (see Book 1, Chapter 2), click the Customize Quick Access Toolbar button and then click the Quick Print item from its drop-down menu.

After adding the Quick Print button to the Quick Access toolbar, you can use this button to print a single copy of all the information in the current worksheet, including any charts and graphics, everything but the notes you've added to cells.

When you click Quick Print, Excel routes the print job to the Windows print queue, which sends the job to the printer. While Excel sends the print job to the print queue, Excel displays a Printing dialog box to inform you of its progress (displaying such updates as *Printing Page 2 of 3*). After this dialog box disappears, you're free to go back to work in Excel. To stop the printing while the job is still being sent to the print queue, click the Cancel button in the Printing dialog box.

If you don’t realize that you want to cancel the print job until after Excel finishes shipping it to the print queue (that is, while the Printing dialog box appears onscreen), you must take these steps:

1. **Right-click the printer icon in the notification area at the far right of the Windows taskbar and then click the Open All Active Printers command from its shortcut menu.**

   The dialog box opens for the printer with the Excel print job in its queue (as described under the Document Name heading in the list box).

2. **Select the Excel print job that you want to cancel in the list box of your printer’s dialog box.**
3. **Choose Document ⇒ Cancel from the menu and then click Yes to confirm you want to cancel the print job.**
4. **Wait for the print job to disappear from the queue in the printer’s dialog box and then click the Close button to return to Excel.**

Working with the Page Setup Options

About the only thing the slightest bit complex in printing a worksheet is figuring out how to get the pages right. Fortunately, the commands in the Page Layout tab give you a great deal of control over what goes on which page.

Two groups of buttons on the Page Layout tab are helpful in getting your page settings exactly as you want them: the Page Setup group and the Scale to Fit group both described in upcoming sections.

TIP To see the effect of changes you make to the page setup settings in the Worksheet area, put the worksheet into Page Layout view by clicking the Page Layout button on the Status bar (pointed out earlier in Figure 5-2) as you work with the command buttons in Page Setup and Scale to Fit groups on the Page Layout tab.

Using the buttons in the Page Setup group

The Page Setup group of the Page Layout tab contains the following commands for getting your page layout just right:

- **Margins:** Select one of three preset margins for the report or click Custom Margins to set your own margins using the Margins tab of the Page Setup dialog box. (See "Massaging the margins" later in this chapter.)
- **Orientation:** Choose between Portrait and Landscape mode for the printing. (See "Getting the lay of the landscape" later in this chapter.)
- **Size:** Select one of the preset paper sizes or to set a custom size or to change the printing resolution or page number on the Page tab of the Page Layout dialog box.
- **Print Area:** Set and clear the Print Area. (See "Setting and clearing the Print Area" immediately following in this chapter.)
- **Breaks:** Insert or remove page breaks. (See "Solving Page Break Problems" later in this chapter.)
- **Background:** Open the Sheet Background dialog box, where you can select a new graphic image or photo to be used as a background for all the worksheets in the workbook. (Note that this button changes to Delete Background as soon as you select a background image.) See Book 2, Chapter 4, for the details.
- **Print Titles:** Open the Sheet tab of the Page Setup dialog box, where you can define rows of the worksheet to repeat at the top and columns at the left as print titles for the report. (See "Putting out the print titles" later in this chapter.)

Setting and clearing the Print Area

Excel includes a special printing feature called the Print Area, which is the portion of the worksheet that you want printed. Begin by selecting the range that you want in your printout. Then, in the Page Layout tab's Page Setup group, choose Print Area ⇒ Set Print Area (or press Alt + PRS) to define that range as the Print Area. Excel then prints just this range whenever you print the worksheet (either with the Quick Print button on the Quick Access toolbar or by choosing File ⇒ Print and then clicking the Print button on the Print screen).

REMEMBER Whenever you fool with the Print Area, you need to keep in mind that after you define it, its cell range is the only one you can print (regardless of what other print area options you select in the Print screen unless you click the Ignore Print Areas check box at the bottom of the very first drop-down menu in the Settings section of the Print screen and until you clear the Print Area).

To clear the Print Area (and therefore go back to the printing defaults Excel establishes in the Print screen), display the Page Layout tab and then choose Print Area ⇒ Clear Print Area (press Alt + PRC).

REMEMBER You can also define and clear the Print Area by displaying the Page Layout tab and clicking the Page Setup group's dialog box launcher (or by pressing Alt + PSP). In the Page Setup dialog box that appears, select the Sheet tab, click the Print Area text box to insert the cursor, and then select the range or ranges in the worksheet. To clear the Print Area from this dialog box, select the cell addresses in the Print Area text box and press the Delete key.

Massaging the margins

The Normal margin settings that Excel applies to a new report use standard top and bottom margins of 0.75 inch (¾ inch) and left and right margins of 0.7 inch with 0.3 inches (just over a ¼ inch) separating the header and footer from the top and bottom margins, respectively.

Besides the Normal margin settings, Excel enables you to choose two other standard margins:

- **Wide** margins with 1-inch top, bottom, left, and right margins and ½ inch separating the header and footer from the top and bottom margins, respectively.
- **Narrow** margins with top and bottom margins of ¾ inch and left and right margins of ¼ inch with slightly more than ¼ inch separating the header and footer from the top and bottom margins,

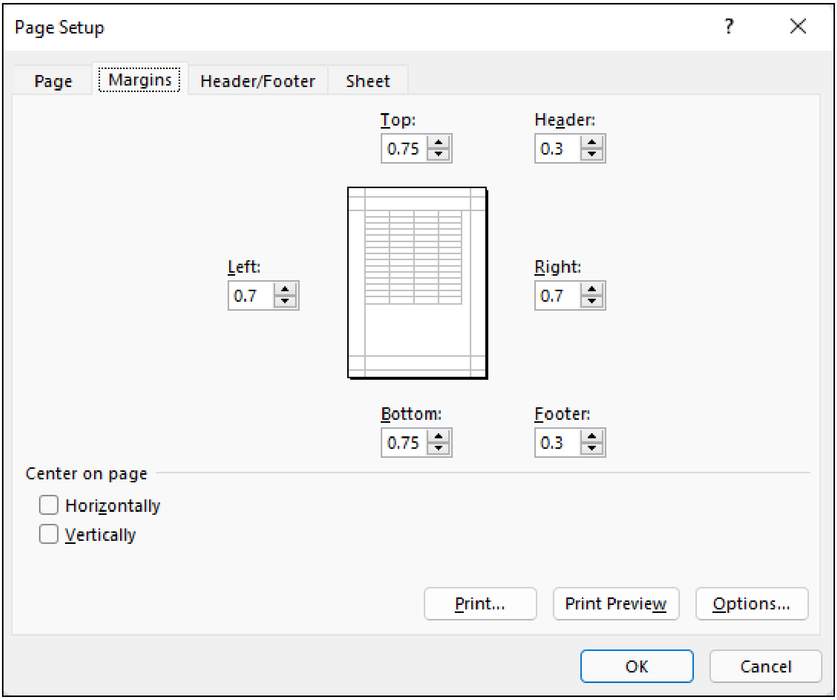
respectively.

Excel gives you three ways to choose Normal, Wide, or Narrow margins or to set custom margins for your printout:

- **Backstage view:** In the Print screen, use the Margins drop-down list under Settings. Select a predefined margin set or click Custom Margins to open the Page Setup dialog box with the Margins tab displayed. Alternatively, click to activate the Show Margins button (pointed out earlier in Figure 5-3) and then drag the margin markers in the print preview area (see Figure 5-6).
- **Page Layout tab:** In the Page Setup group, click Margins. Select a prefab margin set or click Custom Margins to open the Page Setup dialog box with the Margins tab displayed
- **Page Layout dialog box:** In the Page Layout tab, click the Page Setup group's dialog box launcher, and then display the Margins tab, shown in Figure 5-5. Enter the new settings in the Top, Bottom, Left, and Right text boxes — or select the new margin settings with their respective spinner buttons.

TIP

Select one or both Center on Page options in the Margins tab of the Page Setup dialog box (refer to Figure 5-5) to center a selection of data (that takes up less than a full page) between the current margin settings. In the Center on Page section, select the Horizontally check box to center the data between the left and right margins. Select the Vertically check box to center the data between the top and bottom margins.



Top: 0.75

Header: 0.3

Left: 0.7

Right: 0.7

Bottom: 0.75

Footer: 0.3

Center on page

☐ Horizontally

☐ Vertically

FIGURE 5-5: You can adjust your report margins from the Margins tab in the Page Setup dialog box.

If you activate the Show Margins button at the bottom of the Print screen in the Excel Backstage view (Ctrl+P) to change the margin settings, you can modify the column widths as well as the margins. (See Figure 5-6; sample workbook: Income Analysis.xlsx.) To change one of the margins, position the mouse pointer on the desired margin marker (the pointer shape changes to a double-headed arrow) and drag the marker with your mouse in the appropriate direction. When you release the mouse button, Excel redraws the page, using the new margin setting. You may gain or lose columns or rows, depending on what kind of adjustment you make. Changing the column width is the same story: Drag the column marker to the left or right to decrease or increase the width of a particular column.

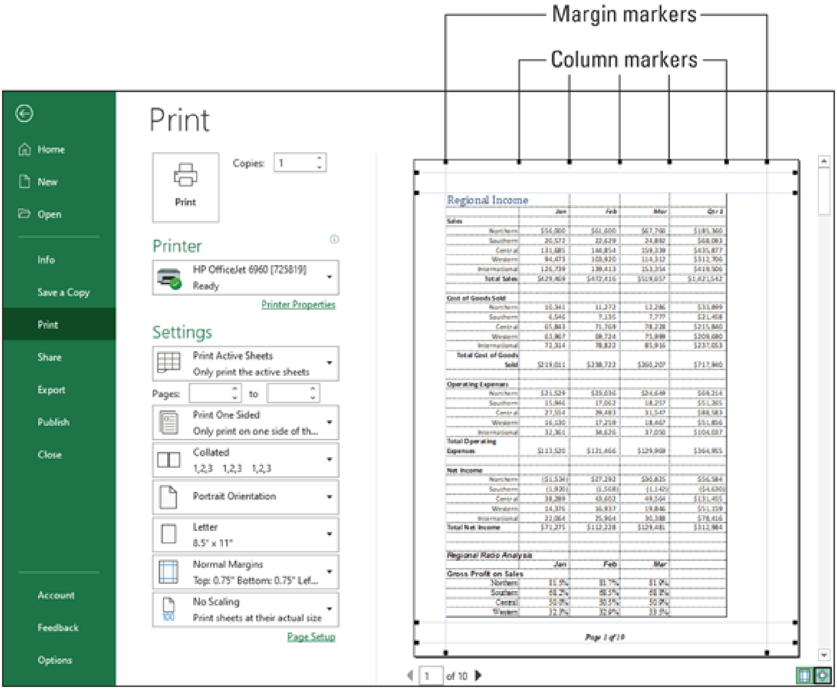
Getting the lay of the landscape

The drop-down menu attached to the Orientation button in the Page Setup group of the Page Layout tab of the Ribbon contains two options:

- **Portrait** (the default), where the printing runs parallel to the short edge of the paper

- **Landscape,** where the printing runs parallel to the long edge of the paper

Because many worksheets are far wider than they are tall (such as budgets or sales tables that track expenditures across all 12 months), you may find that their worksheets page better if you switch the orientation from the normal portrait mode (which accommodates fewer columns on a page because the printing runs parallel to the short edge of the page) to landscape mode.


Margin markers
Column markers
Home
New
Open
Info
Save a Copy
Print
Share
Export
Publish
Close
Account
Feedback
Options
Print
Printer Properties
Page Setup
1 of 10

Print

Copies: 1

Printer

HP OfficeJet 6960 [725819]
Ready

Settings

Print Active Sheets
Only print the active sheets

Pages: to

Print One Sided
Only print on one side of th...

Collated
1,2,3 1,2,3 1,2,3

Portrait Orientation

Letter
8.5" x 11"

Normal Margins
Top: 0.75" Bottom: 0.75" Lef...

No Scaling
Print sheets at their actual size

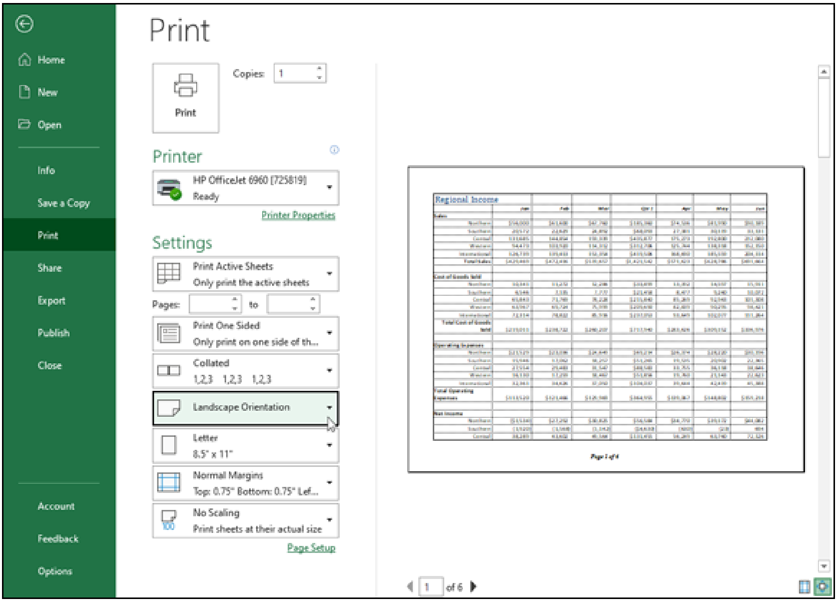
FIGURE 5-6: Drag a marker to adjust its margin in the Page Preview window when the Show Margins check box is selected. (Sample workbook: Income Analysis.xlsx)

In Figure 5-7 (sample workbook: Income Analysis.xlsx), you can see the Print screen in the Backstage view with the first page of a report in landscape mode in the Page Layout view. For this report, Excel can fit three more columns of information on this page in landscape mode than it can in portrait mode. Therefore, the total page count for this report decreases from ten pages in portrait mode to six pages in landscape mode.

Putting out the print titles

Excel's Print Titles enable you to print row and column headings on each page of the report. Print titles are important in multi-page reports where the columns and rows of related data spill over to other pages that no longer show the row and column headings on the first page.

REMEMBER Don't confuse print titles with the header of a report. Even though both are printed on each page, header information prints in the top margin of the report; print titles always appear in the body of the report — at the top, in the case of rows used as print titles, and on the left, in the case of columns.


Print
Home
New
Open
Info
Save a Copy
Print
Share
Export
Publish
Close
Account
Feedback
Options
Print
Printer
Printer Properties
Settings
Page Setup

Copies: 1

HP OfficeJet 6960 [725819]
Ready

Print Active Sheets
Only print the active sheets

Pages: to

Print One Sided
Only print on one side of th...

Collated
1,2,3 1,2,3 1,2,3

Landscape Orientation

Letter
8.5" x 11"

Normal Margins
Top: 0.75" Bottom: 0.75" Lef...

No Scaling
Print sheets at their actual size

1 of 6

FIGURE 5-7: A landscape mode report in Page Layout view. (Sample workbook: Income Analysis.xlsx)

To designate rows and/or columns as the print titles for a report, follow these steps:

1. **In the Page Layout tab's Page Setup group, click the Print Titles button (or press Alt+PI).**

   The Page Setup dialog box appears with the Sheet tab selected.

To designate worksheet rows as print titles, go to Step 2a. To designate worksheet columns as print titles, go to Step 2b.

2a. **Select the Rows to Repeat at Top text box and then drag through the rows with information you want to appear at the top of each page in the worksheet below. If necessary, reduce the Page Setup dialog box to just the Rows to Repeat at Top text box by clicking the text box's Collapse/Expand button.**

In the example I show you in Figure 5-8, I clicked the minimize button associated with the Rows to Repeat at Top text box and then dragged through rows 1 and 2 in column A of the Income Analysis worksheet, and the program entered the row range $1:$2 in the Rows to Repeat at Top text box.

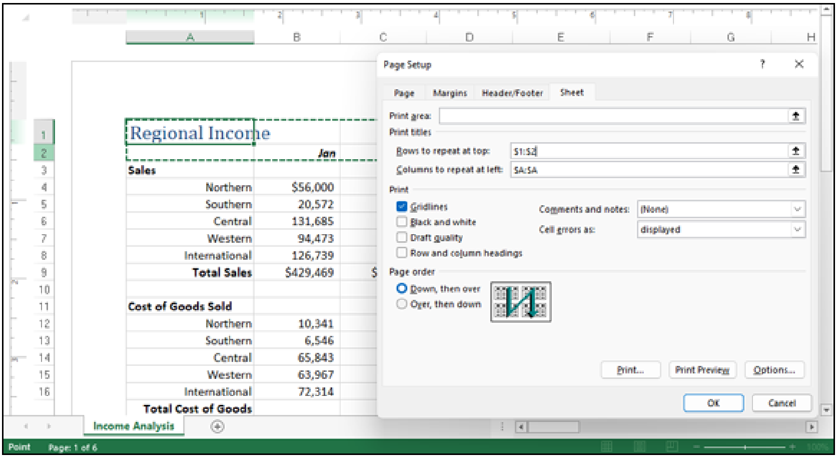
Note that Excel indicates the print-title rows in the worksheet by placing a dotted line (that moves like a marquee) on the border between the titles and the information in the body of the report.

2b. **Select the Columns to Repeat at Left text box and then drag through the range of columns with the information you want to appear at the left edge of each page of the printed report in the worksheet below. If necessary, reduce the Page Setup dialog box to just the Columns to Repeat at Left text box by clicking its Collapse/Expand button.**

Note that Excel indicates the print-title columns in the worksheet by placing a dotted line (that moves like a marquee) on the border between the titles and the information in the body of the report.

1. **Click OK or press Enter to close the Page Setup dialog box or click the Print Preview button to preview the page titles in the Print Preview pane on the Print screen.**

After you close the Page Setup dialog box, the dotted line showing the border of the row and/or column titles disappears from the worksheet.



Regional Income

	Jan
Sales	
Northern	$56,000
Southern	20,572
Central	131,685
Western	94,473
International	126,739
Total Sales	$429,469
Cost of Goods Sold	
Northern	10,341
Southern	6,546
Central	65,843
Western	63,967
International	72,314
Total Cost of Goods	

Page Setup

Print area:

Print titles

Rows to repeat at top: $1:$2

Columns to repeat at left: $A:$A

Print

☑ Gridlines

☐ Black and white

☐ Draft quality

☐ Row and column headings

Comments and notes: (None)

Cell errors as: displayed

Page order

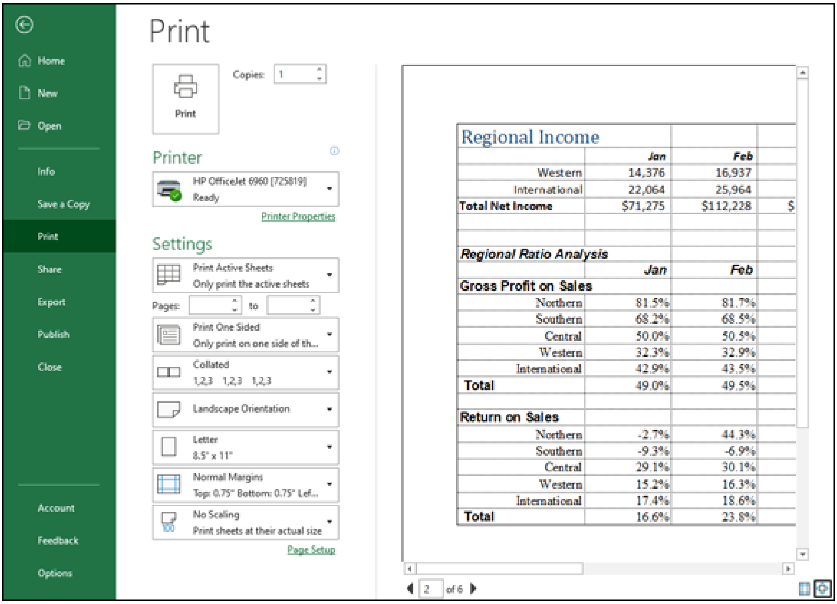
● Down, then over

○ Over, then down

FIGURE 5-8: Specify the rows and columns to use as print titles on the Sheet tab of the Page Setup dialog box.

In Figure 5-8, rows 1 and 2 containing the worksheet title and column headings for the Income Analysis worksheet are designated as the print titles for the report. In Figure 5-9 (sample workbook: Income Analysis.xlsx), you can see the Print Preview window with the second page of the report. Note how these print titles appear on all pages of the report.

REMEMBER To clear print titles from a report if you no longer need them, open the Sheet tab of the Page Setup dialog box and then delete the row and column ranges from the Rows to Repeat at Top and the Columns to Repeat at Left text boxes before you click OK or press Enter.



Copies: 1

HP OfficeJet 6960 [725819]
Ready

Print Active Sheets
Only print the active sheets

Pages: to

Print One Sided
Only print on one side of th...

Collated
1,2,3 1,2,3 1,2,3

Landscape Orientation

Letter
8.5" x 11"

Normal Margins
Top: 0.75" Bottom: 0.75" Lef...

No Scaling
Print sheets at their actual size

Regional Income			
	Jan	*Feb*	
Western	14,376	16,937	
International	22,064	25,964	
Total Net Income	$71,275	$112,228	$
Regional Ratio Analysis			
	Jan	*Feb*	
Gross Profit on Sales			
Northern	81.5%	81.7%	
Southern	68.2%	68.5%	
Central	50.0%	50.5%	
Western	32.3%	32.9%	
International	42.9%	43.5%	
Total	49.0%	49.5%	
Return on Sales			
Northern	-2.7%	44.3%	
Southern	-9.3%	-6.9%	
Central	29.1%	30.1%	
Western	15.2%	16.3%	
International	17.4%	18.6%	
Total	16.6%	23.8%	

2 of 6

FIGURE 5-9: Page 2 of a sample report in Print Preview with defined print titles. (Sample workbook: Income Analysis.xlsx)

Using the buttons in the Scale to Fit group

If your printer supports scaling options, you're in luck because you have more options for squeezing your printout to consume fewer pages. For example, if your current report prints in two pages with just a little data on the second page, you can scale the printout so that it only uses a single page.

This scaling magic occurs in the Page Layout tab's Scale to Fit group, which offers the following three options:

- **Width:** Select the number of pages you want, and Excel scales the width of your printout so that it fits on that number of pages. You can also click Automatic to let Excel figure this out for you.
- **Height:** Select the number of pages you want, and Excel scales the height of your printout so that it fits on that number of pages. You can also click Automatic to let Excel do the hard work for you.
- **Scale:** Select a percentage and Excel shrinks (if you set a percentage less than 100%) or expands (if you set a percentage greater than 100%) the printout.

Alternatively, click the Shrink to Fit group's dialog box launcher to open the Page Setup dialog box with the Page tab displayed. From here, select the Fit To option button and then try changing the number of pages in the Page(s) Wide and Tall text boxes. You can also select the Adjust To option button and setting a shrink or expand percentage in the spin box.

TIP After using the Width and Height Scale to Fit options, you may find that you don't want to scale the printing. Cancel scaling by selecting Automatic on both the Width and Height drop-down lists and then entering **100** in the Scale text (or select 100 with its spinner buttons).

Using the Print options on the Sheet tab of the Page Setup dialog box

The Print section of the Sheet tab of the Page Setup dialog box (Alt +PSP) contains some very useful Print check box options and a couple of drop-down options of which you should be aware:

- **Gridlines:** When selected, prints the column and row gridlines on each page of the report.
- **Comments and notes:** Tells Excel to print all the worksheet comments and notes either at the very end of the data in the report or on pages of the report as they are displayed in the worksheet (see Book 4, Chapter 3 for details on adding notes; see Book 4, Chapter 3 to find out about comments).
- **Cell Errors As:** Tells Excel to print the formula errors in the worksheet cells with blank cells, double dashes, or #NA symbols (see Book 3, Chapter 2 for more information on error values in worksheet formulas).
- **Black and White:** When selected, prints the entire report in black ink, ignoring all color text enhancements and graphics in the report (useful when you only need a draft printout of the worksheet data and want to conserve your color ink cartridges).
- **Draft Quality:** When selected, prints a draft of the report at a lower resolution, thus saving on ink (note that not all printers support different printing at different resolutions so check the Quality option in your printer's Properties dialog box by clicking the Printer Properties link on the Print screen to be sure).

- **Row and Column Headings:** When selected, prints the row headings with the row numbers, and the column headings with the column letters on each page of the report.

TIP Select both the Gridlines and Row and Column Headings check boxes when you want the printed version of your worksheet data to match as closely as possible to their onscreen appearance. This is useful when you need to use the cell references on the printout to help you later locate the cells in the actual worksheet that needs editing. Note that you can select them without opening the Page Setup dialog box by clicking the Layout tab's two Print check boxes (one in the Gridlines section and one in the Headings section). You can also press Alt+PPG to select the Gridlines Print check box and Alt+PPH to select the Headings Print check box.

Headers and Footers

Headers and footers are text that appears on every page of the report. A header is printed in the top margin of the page, and a footer is printed — you guessed it — in the bottom margin. Both are centered vertically in the margins. Unless you specify otherwise, Excel usually doesn't automatically add either a header or footer to a new workbook (the exception is that some templates come with headers and/or footers).

TIP Use headers and footers in a report to identify the document used to produce the report and display the page numbers and the date and time of printing.

The easiest way to add a header or footer to a report is in Page Layout view: Click the Page Layout View button on the Status bar or click the View Tab's Page Layout View button (or press Alt+WP). To work with the header, click Add Header in the top margin of the first page; to work with the footer, click Add Footer in the bottom margin of the first page.

REMEMBER Excel displays the header or footer as three sections: one on the left, one in the center, and one on the right. To create a centered header or footer, click the center section of the header or footer area; to add a left-aligned header or footer, click the left section; to add a right-aligned header or footer, click the right section.

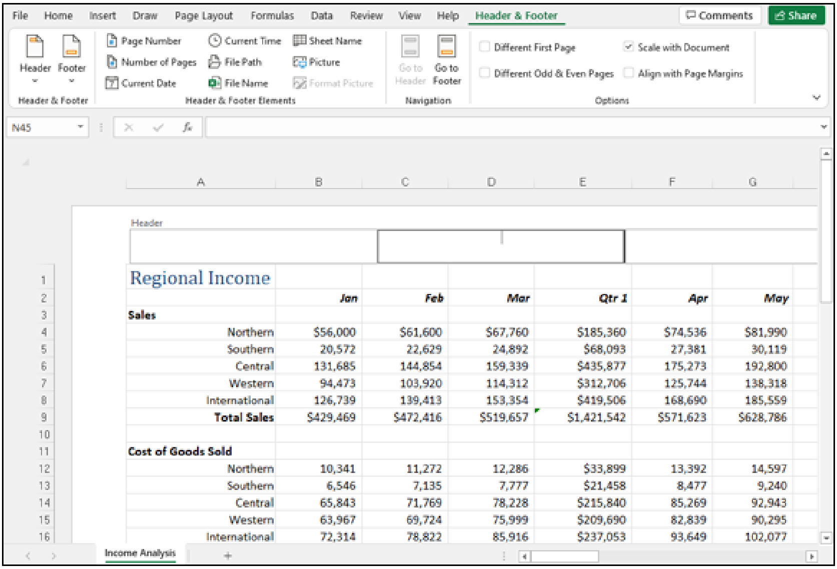
Excel adds a Header & Footer contextual tab, as shown in Figure 5-10 (sample workbook: Income Analysis.xlsx). The Header & Footer tab is divided into four groups: Header & Footer, Header & Footer Elements, Navigation, and Options.

Adding a ready-made header or footer

In the Header & Footer contextual tab's Header & Footer group, the Header and Footer buttons enable you to add predefined headers and footers in an instant by clicking their examples from the drop-down menus that appear.

To create the centered header and footer for the report shown in Figure 5-11 (sample workbook: Income Analysis.xlsx), I clicked the Header & Footer tab's Header button and then I first clicked the following item in the drop-down list:

```
Income Analysis, Confidential, Page 1
```


File
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Help
Header & Footer
Comments
Share
Header
Footer
Header & Footer
Page Number
Number of Pages
Current Date
Current Time
File Path
File Name
Sheet Name
Picture
Format Picture
Header & Footer Elements
Go to Header
Go to Footer
Navigation
☐ Different First Page
☐ Different Odd & Even Pages
☑ Scale with Document
☐ Align with Page Margins
Options
N45
A
B
C
D
E
F
G
Header
Income Analysis

	Regional Income						
1	Regional Income						
2		*Jan*	*Feb*	*Mar*	*Qtr 1*	*Apr*	*May*
3	**Sales**						
4	Northern	$56,000	$61,600	$67,760	$185,360	$74,536	$81,990
5	Southern	20,572	22,629	24,892	$68,093	27,381	30,119
6	Central	131,685	144,854	159,339	$435,877	175,273	192,800
7	Western	94,473	103,920	114,312	$312,706	125,744	138,318
8	International	126,739	139,413	153,354	$419,506	168,690	185,559
9	**Total Sales**	$429,469	$472,416	$519,657	$1,421,542	$571,623	$628,786
10							
11	**Cost of Goods Sold**						
12	Northern	10,341	11,272	12,286	$33,899	13,392	14,597
13	Southern	6,546	7,135	7,777	$21,458	8,477	9,240
14	Central	65,843	71,769	78,228	$215,840	85,269	92,943
15	Western	63,967	69,724	75,999	$209,690	82,839	90,295
16	International	72,314	78,822	85,916	$237,053	93,649	102,077

FIGURE 5-10: Clicking inside the header (or footer) displays the Header & Footer contextual tab. (Sample workbook: Income Analysis.xlsx)

Income Analysis is the name of the worksheet; Confidential is stock text; and Page 1 is the current page number.

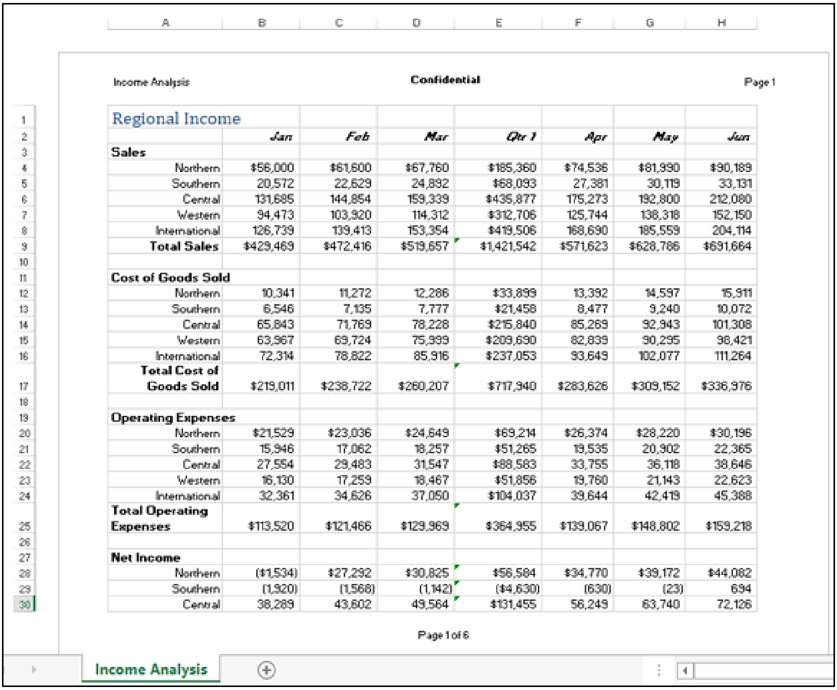
To set up the footer, I clicked the Header & Footer tab's Footer button and then I clicked the following in the drop-down list:

```
Page 1 of ?
```

This item puts the current page number, along with the total number of pages, in the report. You can choose this paging option from either the Header or Footer drop-down menu.

Check out the results in Figure 5-11, which is the first page of the report in Page Layout view. Here you can see the header and footer as they will print. You can also see how choosing Page 1 of ? works in the footer: On the first page, you see the centered footer: `Page 1 of 6`; on the second page, you would see the centered footer `Page 2 of 6`.

TIP If, after selecting a ready-made header or footer, you decide that you no longer need either the header or footer printed in your report, click the header or footer in Page Layout view and then choose the (none) option at the top of the Header button's or Footer button's drop-down menu.



Income Analysis

Confidential

Page 1

	A	B	C	D	E	F	G	H
1	Regional Income							
2		*Jan*	*Feb*	*Mar*	*Qtr 1*	*Apr*	*May*	*Jun*
3	**Sales**							
4	Northern	$56,000	$61,600	$67,760	$185,360	$74,536	$81,990	$90,189
5	Southern	20,572	22,629	24,892	$68,093	27,381	30,119	33,131
6	Central	131,685	144,854	159,339	$435,877	175,273	192,800	212,080
7	Western	94,473	103,920	114,312	$312,706	125,744	138,318	152,150
8	International	126,739	139,413	153,354	$419,506	168,690	185,559	204,114
9	**Total Sales**	$429,469	$472,416	$519,657	$1,421,542	$571,623	$628,786	$691,664
10								
11	**Cost of Goods Sold**							
12	Northern	10,341	11,272	12,286	$33,899	13,392	14,597	15,911
13	Southern	6,546	7,135	7,777	$21,458	8,477	9,240	10,072
14	Central	65,843	71,769	78,228	$215,840	85,269	92,943	101,308
15	Western	63,967	69,724	75,999	$209,690	82,839	90,295	98,421
16	International	72,314	78,822	85,916	$237,053	93,649	102,077	111,264
17	**Total Cost of Goods Sold**	$219,011	$238,722	$260,207	$717,940	$283,626	$309,152	$336,976
18								
19	**Operating Expenses**							
20	Northern	$21,529	$23,036	$24,649	$69,214	$26,374	$28,220	$30,196
21	Southern	15,946	17,062	18,257	$51,265	19,535	20,902	22,365
22	Central	27,554	29,483	31,547	$88,583	33,755	36,118	38,646
23	Western	16,130	17,259	18,467	$51,856	19,760	21,143	22,623
24	International	32,361	34,626	37,050	$104,037	39,644	42,419	45,388
25	**Total Operating Expenses**	$113,520	$121,466	$129,969	$364,955	$139,067	$148,802	$159,218
26								
27	**Net Income**							
28	Northern	($1,534)	$27,292	$30,825	$56,584	$34,770	$39,172	$44,082
29	Southern	(1,920)	(1,568)	(1,142)	($4,630)	(630)	(23)	694
30	Central	38,289	43,602	49,564	$131,455	56,249	63,740	72,126

Page 1 of 6

FIGURE 5-11: The first page of a report in Page Layout view shows you how the header and footer will print. (Sample workbook: Income Analysis.xlsx)

Creating a custom header or footer

Most of the time, the stock headers and footers available on the Header button's and Footer button's drop-down menus are sufficient for your report printing needs. Every once in a while, however, you may want to insert information not available in these list boxes or in an arrangement Excel doesn't offer in the ready-made headers and footers.

For those times, you need to use the command buttons that appear in the Header & Footer Elements group of the Header & Footer Tools contextual tab. These command buttons enable you to blend your own information with that generated by Excel into different sections of the custom header or footer you're creating.

The command buttons in the Header & Footer Elements group include the following:

- **Page Number:** Inserts the `&[Page]` code that prints the current page number.
- **Number of Pages:** Inserts the `&[Pages]` code that prints the total number of pages.
- **Current Date:** Inserts the `&[Date]` code that prints the current date.
- **Current Time:** Inserts the `&[Time]` code that prints the current time.
- **File Path:** Inserts the `&[Path]&[File]` code that prints the folder path along with the name of the workbook file.
- **File Name:** Inserts the `&[File]` code that prints the name of the workbook file.
- **Sheet Name:** Inserts the `&[Tab]` code that prints the name of the worksheet as shown on the sheet tab.
- **Picture:** Inserts the `&[Picture]` code that inserts the image that you select from the Insert Pictures dialog box (see Book 5, Chapter 2 for more on inserting pictures).
- **Format Picture:** Applies the formatting that you choose from the Format Picture dialog box to the `&[Picture]` code that you enter with the Insert Picture button without adding any code of its own.

To use these command buttons in the Header & Footer Elements group to create a custom header or footer, follow these steps:

1. **Put your worksheet into Page Layout view by clicking the Page Layout View button on the Status bar, or by choosing View ⇒ Page Layout View on the Ribbon, or by pressing Alt+WP.**

   In Page Layout view, the text `Add Header` appears centered in the top margin of the first page, and the text `Add Footer` appears centered in the bottom margin.

2. **Click the header or footer section where you want to add your custom header or footer text.**

The Header & Footer contextual tab becomes active on the Ribbon.

3. **To add program-generated information to your custom header or footer such as the filename, worksheet name, current date, and so forth, click its command button in the Header & Footer Elements group.**

   Excel inserts the appropriate header/footer code preceded by an ampersand (&) in the header or footer. These codes are replaced by the actual information (filename, worksheet name, graphic image, and the like) as soon as you click another section of the header or footer or finish the header or footer by clicking the mouse pointer outside of it.

4. **(Optional) To add your own text to the custom header or footer, type it at the insertion point.**

   When joining program-generated information indicated by a header/footer code with your own text, be sure to insert the appropriate spaces and punctuation. For example, to have Excel display `Page 1 of 4` in a custom header or footer, do the following:

   a. *Type the word Page and press the spacebar.*

   b. *Click the Page Number command button and press the spacebar again.*

   c. *Type the word of and press the spacebar a third time.*

   d. *Click the Number of Pages command button.*

   This inserts `Page &[Page] of &[Pages]` in the custom header (or footer).

5. **(Optional) To modify the font, font size, or some other font attribute of your custom header or footer, drag through its codes and text, click the**

Home tab, and then click the appropriate command button in the Font group.

In addition to selecting a new font and font size for the custom header or footer, you can add bold, italics, underlining, and a new font color to its text with the Bold, Italic, Underline, and Font Color command buttons on the Home tab.

6. **After you finish defining and formatting the codes and text in your custom header or footer, click a cell in the Worksheet area to deselect the header or footer area.**

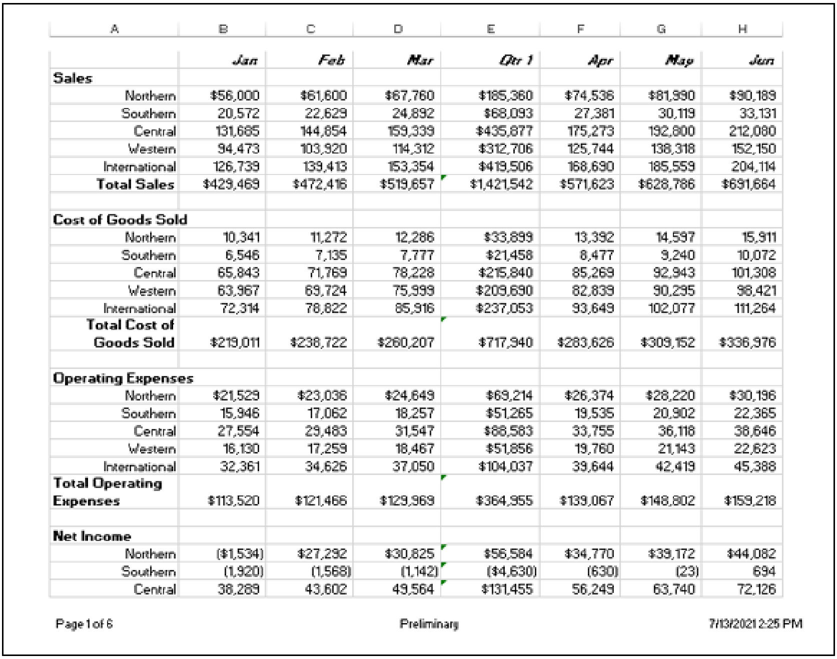
   Excel replaces the header/footer codes in the custom header or footer with the actual information, while at the same time removing the Header & Footer Tools contextual tab from the Ribbon.

Figure 5-12 (sample workbook: Income Analysis.xlsx) shows you a custom footer I added to a worksheet in Page Layout view. This custom footer blends my own text with program-generated page, date, and time information, and uses all three sections: left-aligned page information, a centered Preliminary warning, and right-aligned current date and time.

Creating unique first-page headers and footers

Excel enables you to define a header or footer for the first page that's different from all the rest of the pages. In the Header & Footer tab's Options group, select the Different First Page check box.

Now define the unique header and/or footer for just the first page (now marked First Page Header or First Page Footer). Then, on the second page of the report, define the header and/or footer (marked Header or Footer) for the remaining pages of the report. (See "Adding a ready-made header or footer" and "Creating a custom header or footer" earlier in the chapter for details.)



A	B	C	D	E	F	G	H
	Jan	*Feb*	*Mar*	*Qtr 1*	*Apr*	*May*	*Jun*
Sales							
Northern	$56,000	$61,600	$67,760	$185,360	$74,536	$81,990	$90,189
Southern	20,572	22,629	24,892	$68,093	27,381	30,119	33,131
Central	131,685	144,854	159,339	$435,877	175,273	192,800	212,080
Western	94,473	103,920	114,312	$312,706	125,744	138,318	152,150
International	126,739	139,413	153,354	$419,506	168,690	185,559	204,114
Total Sales	$429,469	$472,416	$519,657	$1,421,542	$571,623	$628,786	$691,664
Cost of Goods Sold							
Northern	10,341	11,272	12,286	$33,899	13,392	14,597	15,911
Southern	6,546	7,135	7,777	$21,458	8,477	9,240	10,072
Central	65,843	71,769	78,228	$215,840	85,269	92,943	101,308
Western	63,967	69,724	75,999	$209,690	82,839	90,295	98,421
International	72,314	78,822	85,916	$237,053	93,649	102,077	111,264
Total Cost of Goods Sold	$219,011	$238,722	$260,207	$717,940	$283,626	$309,152	$336,976
Operating Expenses							
Northern	$21,529	$23,036	$24,649	$69,214	$26,374	$28,220	$30,196
Southern	15,946	17,062	18,257	$51,265	19,535	20,902	22,365
Central	27,554	29,483	31,547	$88,583	33,755	36,118	38,646
Western	16,130	17,259	18,467	$51,856	19,760	21,143	22,623
International	32,361	34,626	37,050	$104,037	39,644	42,419	45,388
Total Operating Expenses	$113,520	$121,466	$129,969	$364,955	$139,067	$148,802	$159,218
Net Income							
Northern	($1,534)	$27,292	$30,825	$56,584	$34,770	$39,172	$44,082
Southern	(1,920)	(1,568)	(1,142)	($4,630)	(630)	(23)	694
Central	38,289	43,602	49,564	$131,455	56,249	63,740	72,126

Page 1 of 6 Preliminary 7/13/2021 2:25 PM

FIGURE 5-12: A worksheet in Page Layout view showing the custom footer. (Sample workbook: Income Analysis.xlsx)

TIP

Use this feature when your worksheet report has a cover page that needs no header or footer. For example, say you have a report that needs the current page number and total pages centered at the bottom of all pages but the first, cover page. To do this, select the Different First Page check box on the Design tab of the Header & Footer Tools contextual tab on the Ribbon and then define a centered stock footer that displays the current page number and total pages (Page 1 of ?) on the second page of the report, leaving the Add Footer text intact on the first page.

Excel correctly numbers both the total number of pages in the report and the current page number without printing this information on the first page. So if your report has a total of six pages (including the cover page), the second page footer reads Page 2 of 6; the third page, Page 3 of 6; and so on, even if the first printed page has no footer at all.

Creating different even and odd page headers and footers

If you plan to do two-sided printing or copying of your worksheet report, you may want to define one header or footer for the even pages and another for the odd pages of the report. That way, the header or footer information (such as the report name or current page) alternates from being right-aligned on the odd pages (printed on the front side of the page) to being left-aligned on the even pages (printed on the back side of the page).

In the Header & Footer tab's Options group, select the Different Odd & Even Pages check box. After that, create a header or footer on the first page of the report (now marked Odd Page Header or Odd Page Footer) in the third, right-aligned section header or footer area and then re-create this header or footer on the second page (now marked Even Page Header or Even Page Footer), this time in the first, left-aligned section.

Solving Page Break Problems

The Page Break Preview feature in Excel enables you to spot page break problems in an instant as well as fix them, such as when the program wants to split onto different pages information that you know should always appear on the same page.

Figure 5-13 (sample workbook: Income Analysis.xlsx) shows a worksheet in Page Break Preview with an example of a bad vertical and horizontal page break that you can remedy by adjusting the location of the page break on Pages 1 and 3. Given the page size, orientation, and margin settings for this report, Excel inserts a vertical page break between columns H and I. This break separates the April, May, and June sales on Page 1 from the Qtr 2 subtotals on Page 3. It also inserts a horizontal page break between rows 30 and 31, splitting the Net Income data.

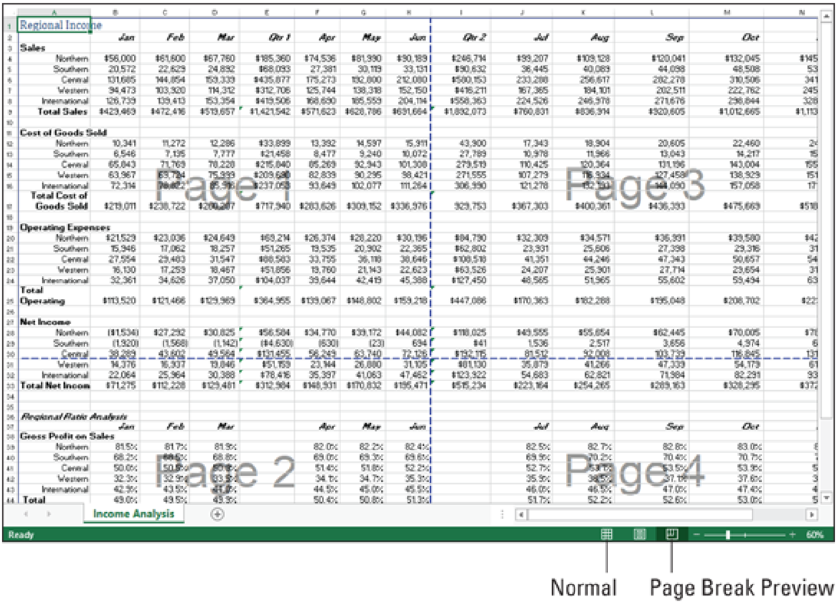


FIGURE 5-13: Preview page breaks in a report in Page Break Preview. (Sample workbook: Income Analysis.xlsx)

To correct the bad vertical page break, you need to move the page break to a column on the left several columns so that it occurs between columns E (with the Qtr 1 subtotals) and F (containing the April sales) so that the second quarter sales and subtotals are printed together on Page 3. To correct the bad horizontal page break, you need to move that break up four rows so that the Net Income heading prints on the page with its data on Page 2.

Figure 5-13 illustrates how you can correct these two bad page breaks in Page Break Preview mode by following these steps:

1. **Click the Status bar's Page Break Preview button (pointed out in Figure 5-13) or choose the Ribbon's View ⇒ Page Break Preview command (or press Alt + WI).**

   This takes you into a Page Break Preview mode that shows your worksheet data at a reduced magnification (60 percent of normal in Figure 5-13) with the page numbers displayed in large, light type and the page breaks shown by heavy dashed lines between the columns and rows of the worksheet.

2. **Position the mouse or Touch pointer somewhere on the page break indicator (one of the heavy dashed lines surrounding the representation of the page) that you need to adjust; when the pointer changes to a double-headed arrow, drag the page break indicator to the desired column or row and release the mouse button.**

   For the example shown in Figure 5-13, I dragged the page break indicator between Pages 1 and 3 to the left so that it's between columns E and F and the page break indicator between Page 1 and 2 up so that it's between row 26 and 27.

   In Figure 5-14 (sample workbook: Income Analysis.xlsx), you can see Page 1 of the report as it then appears in the Print Preview window.

3. **After you finish adjusting the page breaks in Page Break Preview (and, presumably, printing the report), click the Status bar's Normal button (also pointed out in Figure 5-13), or click the Ribbon's View ⇒ Normal command (or press Alt + WL) to return the worksheet to its regular view.**

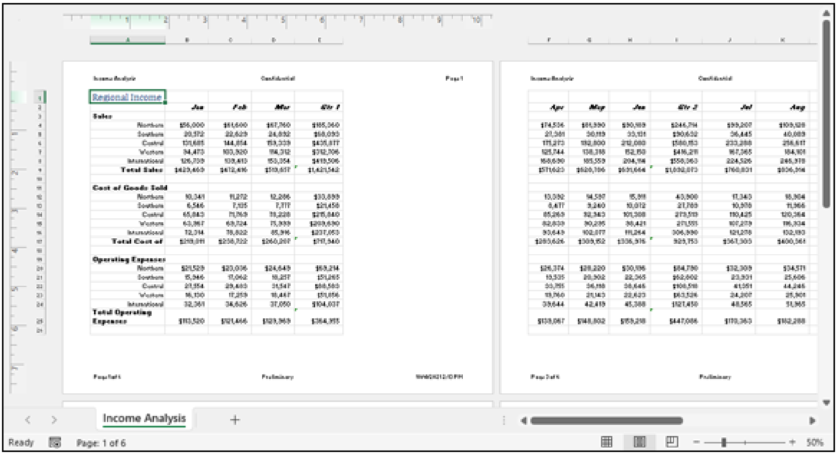


FIGURE 5-14: Page 1 of the report in the Print Preview window after adjusting the page breaks in Page Break Preview mode. (Sample workbook: Income Analysis.xlsx)

TIP You can also insert your own manual page breaks at the cell cursor's position by choosing the Page Layout tab's Breaks ⇒ Insert Page Break command (or press Alt + PBI). To remove a manual page break, select the same cell and choose the Page Layout tab's Breaks ⇒ Remove Page Break command (or press Alt + PBR). To remove all manual page breaks that you've inserted into a report, choose the Page Layout tab's Breaks ⇒ Reset All Page Breaks command (or press Alt + PBA).

Printing the Formulas in a Report

There's one more printing technique you may need every once in a while, and that's how to print the formulas in a worksheet in a report instead of printing the calculated results of the formulas. You can check over a printout of the formulas in your worksheet to make sure that you haven't made a mistake (such as replacing a formula with a number or using the wrong cell references in a formula) before you distribute the worksheet company wide.

Before you can print a worksheet's formulas, you have to display the formulas, rather than their results. In the Formulas tab's Formula Auditing group, click the Show Formulas button (or press either Ctrl + ` or Alt + MH).

Excel then displays the contents of each cell in the worksheet as they normally appear only in the Formula bar or when you're editing them in the cell. Notice that value entries lose their number formatting, formulas appear in their cells (Excel widens the columns with best-fit so that the formulas appear in their entirety), and long text entries no longer spill over into neighboring blank cells.

TIP Excel allows you to toggle between the normal cell display and the formula cell display by pressing Ctrl + `. (That is, press Ctrl and the backtick key — sometimes called the back quote key.)

After Excel displays the formulas in the worksheet, you are ready to print it as you would any other report. You can include the worksheet column letters and row numbers as headings in the printout so that if you do spot an error, you can pinpoint the cell reference right away.

After you print the worksheet with the formulas, return the worksheet to normal by clicking the Formulas tab's Show Formulas button or by pressing Ctrl+`.

Book 3

Formulas and Functions

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Chapter 1

Building Basic Formulas

IN THIS CHAPTER

- Summing data ranges with AutoSum
- Creating simple formulas with operators
- Understanding the operators and their priority in the formula
- Copying formulas and changing the type of cell references
- Building array formulas
- Using names and variables in formulas
- Creating linking formulas that bring values forward
- Controlling formula recalculation
- Dealing with circular references in formulas

You can, if you want, use Excel only to store data. Using the tables that you find out about in Book 6, you can turn Excel into a competent database management system. Nothing wrong with that. However, using Excel only to store data is kind of like having a bicycle and only walking with it everywhere you go: You're missing the best part!

What part of Excel are you missing if you only use the program to store data? One word: *formulas*, which are, hands down, Excel's most powerful and most useful feature. Formulas enable you to take the static, lifeless data you've stored in a worksheet and animate that data to return answers and analyses and generate insights and information. Whether you want to add a few cells together, find the average value in a range, or calculate the tax on an invoice, Excel formulas can get the job done.

So, I hear you thinking, if Excel formulas are so powerful, they must be hideously complex, right? Well, I'm not going to lie to you: Advanced

Excel formulas make the Dead Sea Scrolls look like a first-grade reader. That's the bad news. The oh-so-good news is that most Excel formulas are much simpler and very straightforward and learning how to build these basic formulas doesn't require a graduate degree in math or finance. Are you pumped to learn Excel's most exciting feature? I knew it!

Getting Started with Formulas

A *formula* is a special type of cell entry that performs a calculation. When you complete the cell entry, two things happen, as demonstrated in Figure 1-1:

- The formula result appears in the cell.
- When you select the cell, the formula itself appears in the Formula bar.

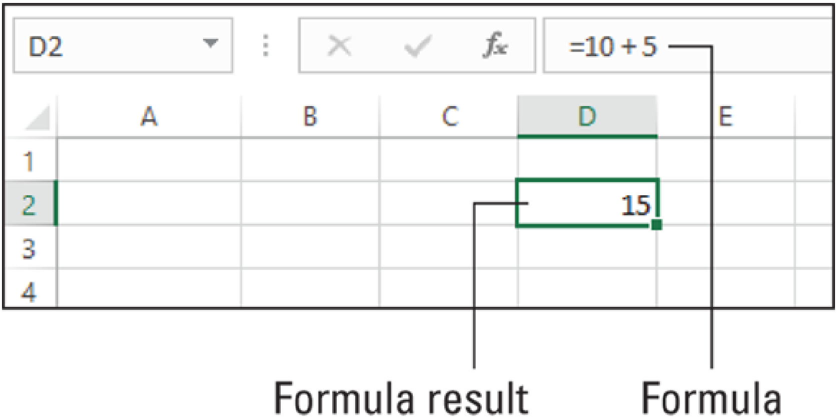


FIGURE 1-1: The formula result appears in the cell, while the formula itself appears in the Formula bar.

Here's the formula shown in the Figure 1-1 example:

```
=10 + 5
```

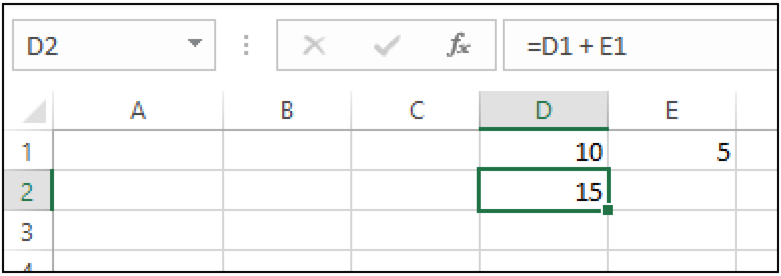
What's going on here? This formula just adds the number 10 and the number 5, resulting in the value 15 that appears in cell D2 of Figure 1-1. Happily, even this simple formula demonstrates pretty much everything you need to know to get started with Excel formulas. That is, it demonstrates the equal sign (=), operands, and operators:

- **Equal sign (=):** All Excel formulas—from the simple addition formula shown in Figure 1-1 to the most complex statistical calculation—begin with the equal sign (=). This symbol says to Excel, “Hey, everything that follows is a formula, okay?”
- **Operands:** An *operand* provides a bit of data for the formula to work with. In the formula used in Figure 1-1, the operands are the numbers 10 and 5. Operands can be raw data values (which are called *constants*), function results (I talk about functions a bit later; see “Augmenting Formulas with Worksheet Functions”), or cell or range addresses. If you enter a cell address in a formula, Excel uses the current value of that cell in your formula. For example, Figure 1-2 shows an updated version of the example formula from Figure 1-1. This time, the value 10 is stored in cell D1 and the value 5 is stored in cell E1, so here's the updated formula (visible in the Formula bar):

  ```
  =D1 + E1
  ```

  REMEMBER The advantage of using cell range addresses instead of constants in formulas is that when you use cell addresses, Excel automatically updates the formula result whenever you change the values in the cells.

- **Operators:** An *operator* is a special symbol that tells Excel what to do with the operands. As demonstrated in Figure 1-1 and 1-2, the addition (+) operator tells Excel to add the two operands. Other common operands are subtraction (-), multiplication (*), and division (/).



D2

=D1 + E1

	A	B	C	D	E
1				10	5
2				15	
3					

FIGURE 1-2: You can use cell addresses as formula operands.

So, when you create a formula, you perform these general steps:

1. Select the cell where you want the formula to appear.
2. Type the equal sign (=) to alert Excel that you're building a formula.
3. Type the first operand, such as a constant, function, cell address, or range coordinates.
4. Type an operator.
5. Type the next operand.
6. Repeat Steps 4 and 5 until your formula is done.
7. Complete the cell entry by clicking the Enter button, pressing Enter, or pressing an arrow key.

Pointing at formula cells

When building your formulas, when you get to a point in the formula where you want to use a cell address as an operand, you can either type the cell address or you can click the cell in the worksheet. Clicking the cell is called *pointing* at the cell and what happens is that Excel inserts the cell address into your formula. (Pointing also works for range operands, where in this case you click and drag over the range you want to use in your formula.)

Using the pointing method to supply a cell address for a formula is often easier and is always a much more foolproof method than entering the cell address by hand. The problem with typing a cell address is that it's all-too easy to type the incorrect row number or column letter (or both), so now your formula is referencing the wrong cell. By contrast, when you click the cell directly, Excel always enters the correct address (assuming you clicked the correct cell!).

Therefore, stick to pointing when building your formulas and restrict typing cell addresses to the odd occasion when you need to enter or edit a cell address and pointing to it is either not practical or just too much trouble.

WARNING As with the other types of cell entries, you must take some action to complete a formula and enter it into the current cell (such as clicking the Enter button on the Formula bar, pressing the Enter key, or pressing an arrow key). Unlike when entering numeric or text entries, however, you want to stay clear of clicking another cell to complete the data entry. This is because, when you click a cell when building or editing a formula on the Formula bar, more often than not, you end up not only selecting the new cell, but also adding its address to the otherwise complete formula.

TECHNICAL STUFF

FORMULAS AND FORMATTING

When defining a formula that uses operators or functions, Excel picks up the number formatting of the cells that are referenced in the formula. For example, if you add cell A2 to B3, as in =A2+B3, and cell B3 is formatted with the Currency Style format, the result will inherit this format and be displayed in its cell using the Currency Style.

As soon as you complete a formula entry, Excel calculates the result, which then displays it inside the cell within the worksheet. (The contents of the formula, however, continue to be visible on the Formula bar anytime the cell is active.) If you make an error in the formula that prevents Excel from being able to calculate the formula at all, Excel displays an Alert dialog box suggesting how to fix the problem. If, however, you make an error that prevents Excel from being able to display a proper result when it calculates the formula, the program displays an Error value rather than the expected computed value. (See Book 3, Chapter 2 for details on dealing with both types of errors in formulas.)

Editing formulas

As with numeric and text entries, you can edit the contents of formulas either in their cells or on the Formula bar. To edit a formula in its cell, double-click the cell or press F2 to position the insertion point in that cell. (Double-clicking the cell positions the insertion point in the middle of the formula, whereas pressing F2 positions it at the end of the formula — you can also double-click at the beginning or end of the cell to position the insertion point there.) To edit a formula on the

Formula bar, use the I-beam mouse to position the insertion point at the place in the formula that needs editing first.

As soon as you put the Excel program into Edit mode, Excel displays each of the cell references in the formula within the cell in a different color and uses each color to outline the corresponding cell or cell range in the worksheet. This coloration enables you to quickly identify the cells and their values that are referred to in your formula and, if necessary, modify them as well. You can use any of the four sizing handles that appear around the cell or cell range to modify the cell selection in the worksheet and consequently update the cell references in the formula.

TIP

USING EXCEL LIKE A HANDHELD CALCULATOR

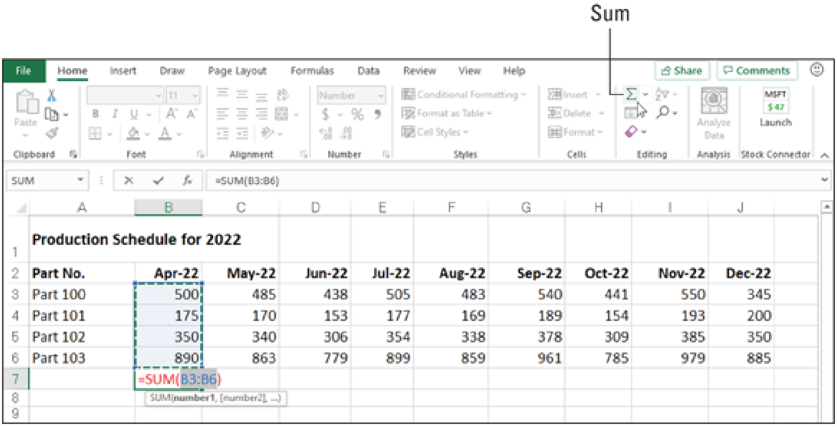
Sometimes, you may need to calculate the number that you need to input in a cell as a constant. Instead of reaching for your smartphone Calculator app to compute the needed value and then manually entering it into a cell of your worksheet, you can set up a formula in the cell that returns the number that you need to input and then convert the formula into a constant value. You convert the formula into a constant by pressing F2 to edit the cell, immediately pressing F9 to recalculate the formula and display the result on the Formula bar, and then clicking the Enter button on the Formula bar or pressing the Enter key to input the calculated result into the cell (as though you had manually input the result in the cell).

Using AutoSum to add numbers

The easiest and often the most used formula that you will create is the one that totals rows and columns of numbers in your worksheet. Usually, to total a row or column of numbers, you can click the Sum command button (the one with the Σ on it) on the Ribbon's Home tab, in the Editing group. When you click Sum, Excel inserts the built-in SUM function into the active cell and simultaneously selects what the program thinks is the most likely range of numbers that you want summed.

TIP Instead of taking the time to click the Sum button on the Home tab, it's often faster and easier to press Alt+ = (equal sign) to insert the SUM function in the current cell and have Excel select the range of cells most likely to be totaled.

Figure 1-3 (sample workbook: Production Schedule 2022.xlsx) demonstrates how this works. For this figure, I positioned the cell cursor in cell B7, which is the first cell where I need to build a formula that totals the various parts produced in April. I then clicked the Sum button (pointed out in Figure 1-3) on the Ribbon's Home tab.


Sum

File
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Help
Share
Comments
Paste
Clipboard
Font
Alignment
Number
Conditional Formatting
Format as Table
Cell Styles
Styles
Insert
Delete
Format
Cells
Editing
Analyze Data
Analysis
MSFT
Launch
Stock Connector

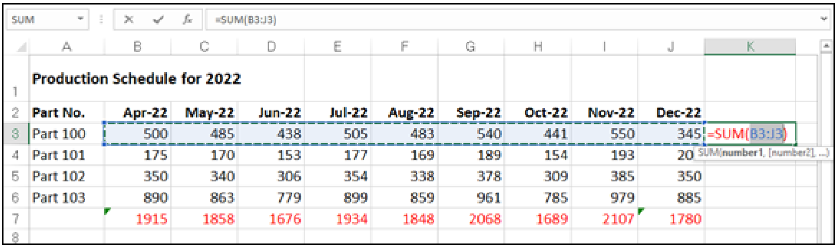
SUM =SUM(B3:B6)

	A	B	C	D	E	F	G	H	I	J
1	Production Schedule for 2022									
2	Part No.	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22
3	Part 100	500	485	438	505	483	540	441	550	345
4	Part 101	175	170	153	177	169	189	154	193	200
5	Part 102	350	340	306	354	338	378	309	385	350
6	Part 103	890	863	779	899	859	961	785	979	885
7		=SUM(B3:B6)								
8		SUM(number1, [number2], ...)								
9										

FIGURE 1-3: Using AutoSum to create a SUM formula that totals a column of numbers. (Sample workbook: Production Schedule 2022.xlsx)

As Figure 1-3 shows, Excel inserts an equal sign followed by the SUM function and correctly suggested the cell range B3:B6 as the argument to this function (that is, the range to be summed). Because Excel correctly selected the range to be summed (leaving out the date value in cell B2), all I have to do is click the Enter button on the Formula bar to have the April total calculated.

Figure 1-4 (sample workbook: Production Schedule 2022.xlsx) shows another example of using AutoSum to instantly build a SUM formula, this time to total the monthly production numbers for Part 100 in cell K3. Again, all I did to create the formula shown in Figure 1-4 was to select cell K3 and then click the Sum button. Again, Excel correctly selected B3:J3 as the range to be summed (rightly ignoring cell A3 with the row title) and input this range as the argument of the SUM function. All that remains to be done is to click the Enter button on the Formula bar to compute the monthly totals for Part 100.



	A	B	C	D	E	F	G	H	I	J	K
1	**Production Schedule for 2022**										
2	**Part No.**	**Apr-22**	**May-22**	**Jun-22**	**Jul-22**	**Aug-22**	**Sep-22**	**Oct-22**	**Nov-22**	**Dec-22**	
3	Part 100	500	485	438	505	483	540	441	550	345	=SUM(B3:J3)
4	Part 101	175	170	153	177	169	189	154	193	20	
5	Part 102	350	340	306	354	338	378	309	385	350	
6	Part 103	890	863	779	899	859	961	785	979	885	
7		1915	1858	1676	1934	1848	2068	1689	2107	1780	
8											

FIGURE 1-4: Using the AutoSum feature to create a SUM formula that totals a row of numbers. (Sample workbook: Production Schedule 2022.xlsx)

If for some reason AutoSum doesn't select the entire or correct range that you want summed, you can adjust the range by dragging the cell cursor through the cell range or by clicking the marquee around the cell range, which turns the marching ants into a solid-colored outline. Then position the mouse pointer on one of the sizing handles at the four corners. When the mouse pointer turns into a thick white arrowhead pointing to the center of a pair of black double-crossed arrows, drag the outline until it includes all the cells you want included in the total.

TIP

WHEN AUTOSUM DOESN'T SUM

Although the Sum button's primary function is to build formulas with the SUM function that totals ranges of numbers, that's not its only function (pun intended). Indeed, you can have the AutoSum feature build formulas that compute the average value, count the number of values, or return the highest or lowest value in a range — all you have to do is click the drop-down button that's attached to the Sum command button on the Home tab and then click Average, Count Numbers, Max, or Min from its drop-down menu.

Also, don't forget about the Average, Count, and Sum indicator on the Status bar. This indicator automatically shows you the average value, the count of the numbers, and the total of all numbers in the current cell selection. You can use this feature to preview the total that's to be returned by the SUM formula that you create with the AutoSum button by selecting the cell range that contains the numbers to be summed.

REMEMBER All Excel functions enclose their argument(s) in a pair of parentheses, as shown in the examples with the SUM function. Even those rare functions that don’t require any arguments at all still require the use of a closed pair of parentheses (even when you don’t put anything inside of them).

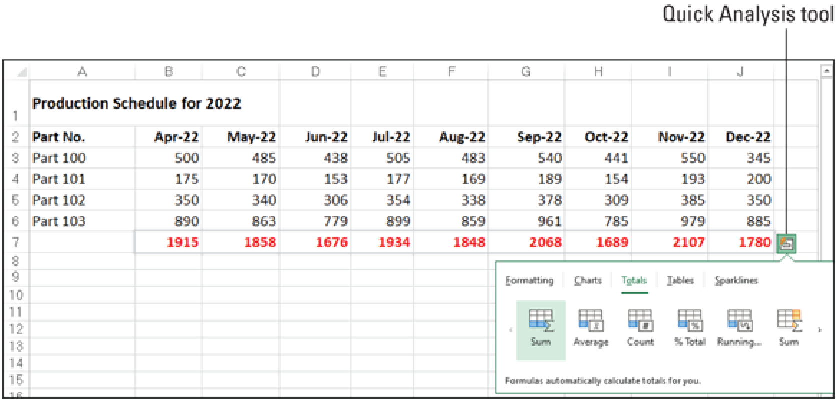
Using Quick Analysis to add numbers

Instead of resorting to the Sum button and AutoFill to create totals for a worksheet table, you can use the Totals feature on the Quick Analysis tool to get the job done. The Quick Analysis tool offers a bevy of features for doing anything from adding conditional formatting, charts, PivotTables, and sparklines to your worksheet tables. And it turns out Quick Analysis is also a whiz at adding running totals and sums to the rows and columns of your new worksheet tables.

To use the Quick Analysis tool, select the worksheet range's data cells and then click the Quick Analysis button that automatically appears in the lower-right corner of the last selected cell. A palette of options (from Formatting to Sparklines) appears right beneath the Quick Analysis tool.

To add totals to your selected data, first click the Totals tab. You then click one of the Sum buttons (the buttons where the icon is a worksheet containing a Sigma):

- Click the first Sum button (the one where the bottom row is highlighted) to add column totals in a new row below the selected range, as shown in Figure 1-5 (sample workbook: Production Schedule 2022.xlsx).
- Click the second Sum button (the one where the rightmost column is highlighted) to add row totals in a new column to the right of the selected range.


Quick Analysis tool
Formatting
Charts
Totals
Tables
Sparklines
Sum
Average
Count
% Total
Running...
Sum
Formulas automatically calculate totals for you.

	A	B	C	D	E	F	G	H	I	J
1	Production Schedule for 2022									
2	Part No.	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22
3	Part 100	500	485	438	505	483	540	441	550	345
4	Part 101	175	170	153	177	169	189	154	193	200
5	Part 102	350	340	306	354	338	378	309	385	350
6	Part 103	890	863	779	899	859	961	785	979	885
7		1915	1858	1676	1934	1848	2068	1689	2107	1780

FIGURE 1-5: Adding a row of totals with the Quick Analysis tool's Sum button. (Sample workbook: Production Schedule 2022.xlsx)

TIP

If you have trouble selecting the Quick Analysis button to open its palette for any reason, right-click the cell selection and select the Quick Analysis item on its shortcut menu.

Building formulas with computational operators

Many of the simpler formulas that you build require the sole use of Excel's operators, which are the symbols that indicate the type of calculation that is to take place between the cells and/or constants interspersed between them. Excel uses four different types of computational operators: arithmetic, comparison, text, and reference. Table 1-1 shows all these operators arranged by type and accompanied by an example.

TABLE 1-1 The Different Types of Operators in Excel

Type	*Character*	*Operation*	*Example*
Arithmetic	+	Addition	=A2+B3
	-	Subtraction or negation	=B3-A2 or -C4
	*	Multiplication	=A2*B3
	/	Division	=B3/A2
	%	Percent (dividing by 100)	=B3%
	^	Exponentiation	=A2^3
Comparison	=	Equal to	=A2=B3
	>	Greater than	=B3>A2
	<	Less than	=A2<B3

>=		Greater than or equal to	=B3 >= A2
<=		Less than or equal to	=A2 <= B3
<>		Not equal to	=A2 <> B3
&	Text	Concatenates (connects) entries to produce one continuous entry	=A2 & " " & B3
:	Reference	Range operator that includes	=SUM(C4:D17)
,		Union operator that combines multiple references into one reference	=SUM(A2, C4:D17, B3)
(space)		Intersection operator that produces one reference to cells in common with two references	=SUM(C3:C6 C3:E6)

More about operators

Most of the time, you'll rely on the arithmetic operators when building formulas in your worksheets that don't require functions because these operators perform computations between the numbers in the various cell references and produce new mathematical results.

The comparison operators, on the other hand, produce only the logical value TRUE or the logical value FALSE, depending on the result of the comparison. For example, say that you enter the following formula in cell A10:

```
=B10 <> C10
```

If B10 contains the number 15 and C10 contains the number 20, the formula in A10 returns the logical value TRUE. If, however, both cell B10 and C10 contain the value 12, the formula returns the logical value FALSE.

The single text operator (the so-called ampersand) is used in formulas to join two or more text entries (an operation with the highfalutin' name *concatenation*). For example, suppose that you enter the following formula in cell C2:

```
=A2 & B2
```

If cell A2 contains `John` and cell B2 contains `Smith`, the formula returns the new (squashed together) text entry, `JohnSmith`. To have the formula insert a space between the first and last names, include a space as part of the concatenation as follows:

```
=A2 & " " & B2
```

TIP You most often use the comparison operators with the IF function when building more complex formulas that perform one type of operation when the IF condition is TRUE and another when it is FALSE. You use the concatenating operator (&) when you need to join text entries that come to you entered in separate cells but that need to be entered in single cells (like the first and last names in separate columns). See Book 3, Chapter 2 for more on logical formulas, and Book 3, Chapter 6 for more on text formulas.

Order of operator precedence

When you build a formula that combines different computational operators, Excel follows the set order of operator precedence, as shown in Table 1-2. When you use operators that share the same level of precedence, Excel evaluates each element in the equation by using a strictly left-to-right order.

TABLE 1-2 Natural Order of Operator Precedence in Formulas

Precedence	*Operator*	*Type/Function*
1	–	Negation
2	%	Percent
3	^	Exponentiation
4	* and /	Multiplication and Division
5	+ and –	Addition and Subtraction
6	&	Concatenation
7	=, <, >, <=, >=, <>	All Comparison Operators

Suppose that you enter the following formula in cell A4:

```
=B4 + C4 / D4
```

Because division (like multiplication) has a higher level of precedence than addition (4 versus 5), Excel evaluates the division between cells C4 and D4 and then adds that result to the value in cell B4. If, for example, cell B4 contains 2, C4 contains 9, and D4 contains 3, Excel would essentially be evaluating this equation in cell A4:

```
=2+9/3
```

In this example, the calculated result displayed in cell A4 is 5 because the program first performs the division (9/3) that returns the result 3 and then adds it to 2 to get the final result of 5.

If you had wanted Excel to evaluate this formula in a strictly left-to-right manner, you could get it to do so by enclosing the leftmost operation (the addition between B4 and C4) in a closed pair of parentheses. Parentheses alter the natural order of precedence so that any operation enclosed within a pair is performed before the other operations in the formula, regardless of level in the order. (After that, the natural order is once again used.)

To have Excel perform the addition between the first two terms (B4 and C4) and then divide the result by the third term (cell D4), you modify the original formula by enclosing the addition operation in parentheses as follows:

```
=(B4 + C4) / D4
```

Assuming that cells B4, C4, and D4 still contain the same numbers (2, 9, and 3, respectively), the formula now calculates the result as 3.666667 and returns it to cell A4 (2 + 9 = 11 and 11/3 = 3.66667).

If necessary, you can *nest* parentheses in your formulas by putting one set of parentheses within another (within another, within another, and so on). When you nest parentheses, Excel performs the calculation in the innermost pair of parentheses first before anything else and then starts performing the operations in the outer parentheses.

Consider the following sample formula:

```
=B5 + (C5 – D5) / E5
```

In this formula, the parentheses around the subtraction (C5–D5) ensure that it is the first operation performed. After that, however, the natural order of precedence takes over. So, the result of the subtraction is then divided by the value in E5, and that result is then added to the value in B5. If you want the addition to be performed before the division, you need to nest the first set of parentheses within another set as follows:

```
=(B5 + (C5 – D5)) / E5
```

In this revised formula, Excel performs the subtraction between the values in C5 and D5, adds the result to the value in cell B5, and then divides that result by the value in cell E5.

WARNING Of course, the biggest problem with parentheses is that you have to remember to enter them in pairs. If you forget to balance each set of nested parentheses by having a right parenthesis for every left parenthesis, Excel displays an Alert dialog box, informing you that it has located an error in the formula. Excel also suggests a correction that would balance the parentheses used in the formula. Although the suggested correction corrects the imbalance in the formula, it unfortunately doesn't give you the calculation order that you wanted — and if accepted, the suggested correction would give you what you consider an incorrect result. For this reason, be very careful before you click the Yes button in this kind of Alert dialog box. Do so only when you're certain that the corrected parentheses give you the calculation order that you want. Otherwise, click No and balance the parentheses in the formula by adding the missing parenthesis or parentheses yourself.

Augmenting Formulas with Worksheet Functions

Excel supports a wide variety of built-in worksheet functions that you can use when building formulas. A *function* is a kind of predefined formula that performs a specific calculation. For example, consider the following formula:

```
=A1 + A2 _ A3 + A4 + A5 + A6 + A7 + A8 + A9 + A10
```

You can imagine how tedious that would be to type into a cell. To make your Excel life easier, you can use the SUM function, instead, which sums whatever range address (or addresses) you provide (these inputs are known as *arguments*):

```
=SUM(A1:A10)
```

The most popular built-in function is by far the SUM function, which is automatically inserted when you click the Sum command button on the Ribbon's Home tab. (Keep in mind that you can also use this drop-down button attached to the Sum button to insert the AVERAGE, COUNT, MAX, and MIN functions — see the "Using AutoSum to add numbers" section previously in this chapter for details.)

Inserting a function

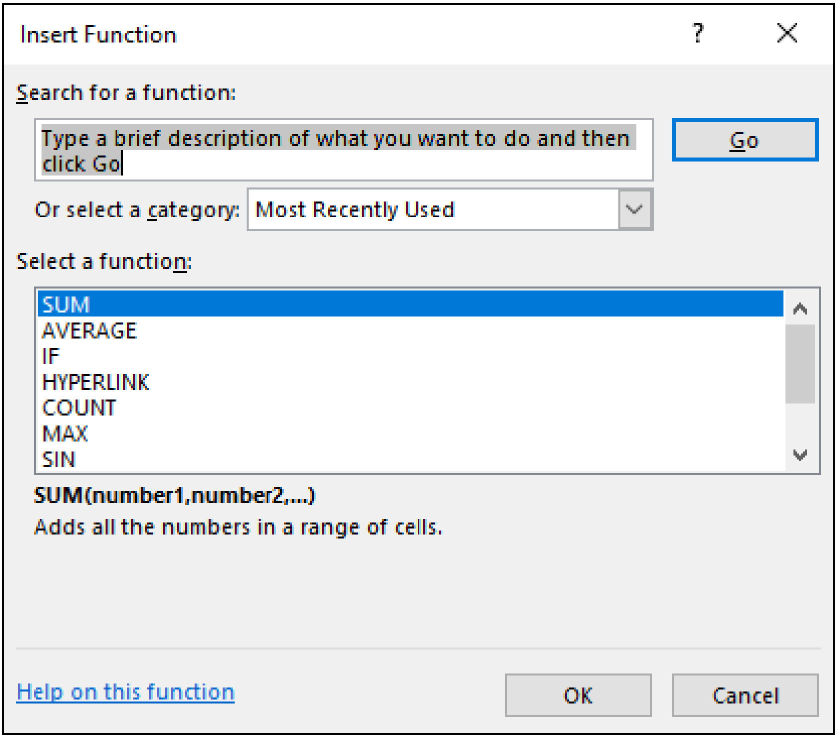
To use other Excel functions, you can type the function and its arguments, if you happen to know the correct syntax. Otherwise, you can use either the Insert Function button or the Ribbon's Formulas tab.

Entering a function manually

If you know the name of the function you want to insert and you know its syntax, it's often easier to just type the function manually into your formula. When you begin typing a function name in a formula, Excel's AutoComplete feature kicks in by displaying a drop-down menu with the names of all the functions that begin with the character(s) you've typed. You can then insert the name of the function you want to use by double-clicking its name on this drop-down menu, or highlighting the name and pressing Tab. Excel then inserts the function name along with the open parenthesis as in =DATE(. Now you fill in the rest of the function, add a closing (right) parenthesis, and you're done.

Using the Insert Function button

When you click the Insert Function button on the Formula bar (the one with the *fx*), Excel displays the Insert Function dialog box, similar to the one shown in Figure 1-6. You can then use its options to find and select the function that you want to use and to define the argument or arguments that the function requires to perform its calculation.



Insert Function

Search for a function: Type a brief description of what you want to do and then click Go

Or select a category: Most Recently Used

Select a function: SUM

SUM(number1,number2,...)

Adds all the numbers in a range of cells.

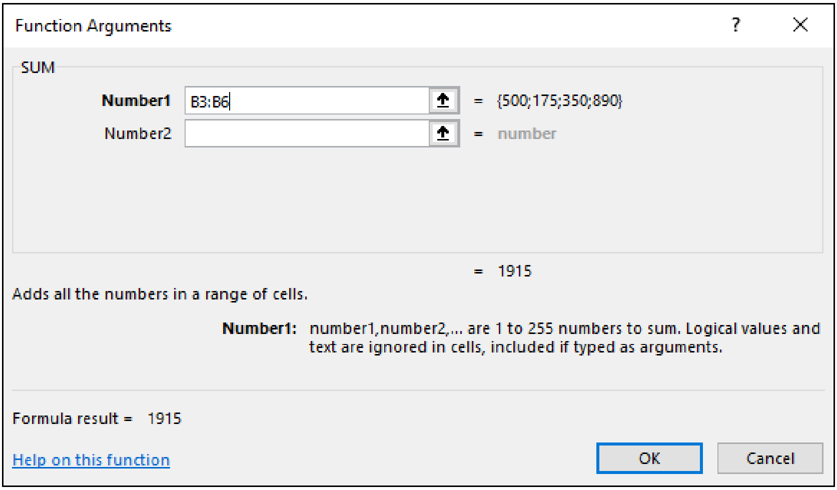
FIGURE 1-6: Use the Insert Function dialog box to, you know, insert a function.

To select the function that you want to use, you can use any of the following methods:

- Click the function name if it's one that you've used lately and is therefore already listed in the Select a Function list box.
- Select the name of the category of the function that you want to use from the Or Select a Category drop-down list box (Most Recently Used is the default category) and then select the function that you want to use in that category from the Select a Function list box.
- Replace the text "Type a brief description of what you want to do and then click Go" in the Search for a Function text box with keywords or a phrase about the type of calculation that you want to do (such as "return on investment"). Click the Go button or press Enter and click the function that you want to use in the Recommended category displayed in the Select a Function list box.

When selecting the function to use in the Select a Function list box, click the function name to have Excel give you a short description of what the function does, displayed underneath the name of the function with its argument(s) shown in parentheses (referred to as the function's *syntax*). To get help on using the function, click the Help on This Function link displayed in the lower-left corner of the Insert Function dialog box to open the Help window in its own pane on the right. When you finish reading and/or printing this help topic, click the Close button to close the Help window and return to the Insert Function dialog box.

When you click OK after selecting the function that you want to use in the current formula, Excel inserts the function name followed by a closed set of parentheses on the Formula bar. At the same time, the program closes the Insert Function dialog box and then opens the Function Arguments dialog box, similar to the one shown in Figure 1-7.



Number1 B3:B6 = {500;175;350;890}

Number2 = number

= 1915

Adds all the numbers in a range of cells.

Number1: number1,number2,... are 1 to 255 numbers to sum. Logical values and text are ignored in cells, included if typed as arguments.

Formula result = 1915

FIGURE 1-7: Use the Function Arguments dialog box to specify the arguments for a function.

Using the Ribbon's Formulas tab

You can also insert a function using the Ribbon's Formulas tab. In the Function Library group, you see drop-down lists for several function categories: Financial, Logical, Text, Date & Time, Lookup & Reference, and Math & Trig. In addition, you can click More Functions to eyeball a few more categories: Statistical, Engineering, Cube, Information, Compatibility, and Web. If the function you want is one you've used recently, it may appear on the handy Recently Used drop-down list. Click the category that contains the function you want and then click the function to insert it into your formula and open the Function Arguments dialog box.

TIP

For your formula-building convenience, note that in the Ribbon's Formulas tab, the Function Library group also includes the same AutoSum button that's available in the Home tab's Editing group.

Entering function arguments

A function *argument* is an input that gets fed into the function's internal calculations. Almost all functions accept at least one argument, and most functions accept two or more. And, yep, in case you're wondering: Some functions don't require any arguments. For example, the TODAY function returns the current date, with no arguments required.

Function arguments come in two flavors:

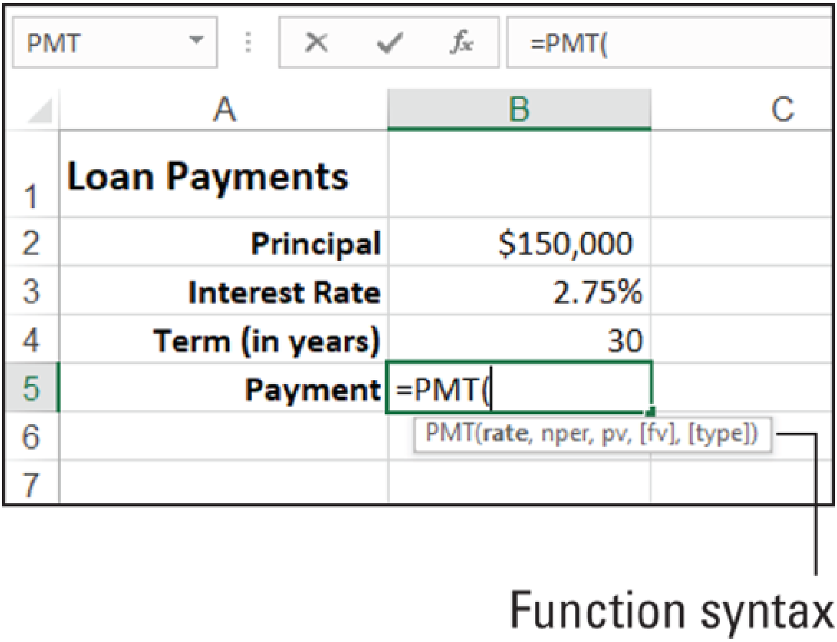
- **Required:** Arguments that you must include for the function to return a result.
- **Optional:** Arguments that you can omit and still get a valid result from the function.

All functions — even those that don’t take any arguments, such as the TODAY function — follow the function name by a set of left and right parentheses. For example, the TODAY function requires no arguments, so it appears in a formula as TODAY( ). If the function requires arguments, these arguments must appear within the parentheses following the function name. When a function requires multiple arguments, such as the PMT function (used to calculate a loan payment), you must enter the arguments in the order designated by the function's syntax (so that Excel knows which argument is which).

How do you know the proper order? That comes from the function's *syntax*, which specifies the function name, its arguments, the data type of each argument, the order to enter those arguments, and which arguments are required.

The easiest way to see a function's syntax is to type the function's name in a formula followed by the opening (left) parenthesis. Below the cell, Excel displays a ScreenTip that contains the syntax. Figure 1-8 (sample workbook: Loan Payments.xlsx) shows the syntax that appears for the PMT function. Look closely and you'll notice three things about this syntax:

- The arguments are displayed in the order you must enter them, separated by commas.
- The current argument (that is, the argument you're about to type or click) is displayed in bold type. When you enter that argument and type a comma, the next argument in the list (if there is one) is displayed in bold.
- Optional arguments are surrounded by square brackets (such as [fv] and [type] for the PMT function).

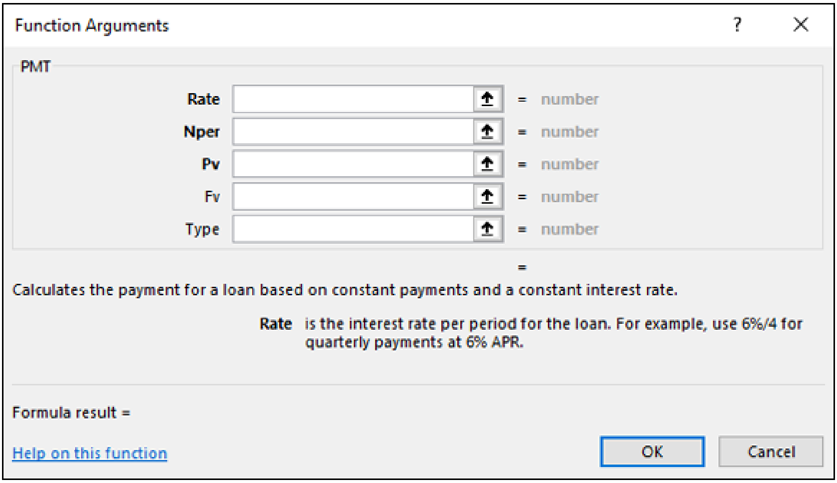


	A	B	C
1	Loan Payments		
2	Principal	$150,000	
3	Interest Rate	2.75%	
4	Term (in years)	30	
5	Payment	=PMT(	
6			
7			

FIGURE 1-8: Type the function name followed by the left parenthesis to see a ScreenTip with the function syntax. (Sample workbook: Loan Payments.xlsx)

If you're not typing the function by hand — that is, you used the Insert Function button or the Formulas tab to get your function off the ground — the function syntax appears in the Function Arguments dialog box. Figure 1-9 shows the Function Arguments dialog box for the PMT function. Again, you can notice three things about the syntax here:

- Although arguments are displayed in the order required by the function (from top to bottom), you can fill in the text boxes in any order you prefer.
- To the right of each argument is a text label that tells you the data type of the argument (such as “number” or “date”).
- Required argument names appear in bold type (Rate, Nper, and Pv in Figure 1-9), while optional argument names appear in regular type (Fv and Type in Figure 1-9).



Calculates the payment for a loan based on constant payments and a constant interest rate.

Rate is the interest rate per period for the loan. For example, use 6%/4 for quarterly payments at 6% APR.

FIGURE 1-9: The Function Arguments dialog box shows the function syntax.

When you use the text boxes in the Function Arguments dialog box to input the arguments for a function, you can select the cell or cell range in the worksheet that contains the entries that you want used. Click the text box for the argument that you want to define and then either start dragging the cell cursor through the cells or, if the Function Arguments dialog box is obscuring the first cell in the range that you want to select, click the Collapse Dialog Box button located to the immediate right of the text box. Dragging or clicking this button reduces the Function Arguments dialog box to just the currently selected argument text box, thus enabling you to drag through the rest of the cells in the range.

If you started dragging without first clicking the Collapse Dialog Box button, Excel automatically expands the Function Arguments dialog box as soon as you release the mouse button. If you clicked the Collapse Dialog Box button, you have to either press Enter or click the Expand Dialog Box button (which replaces the Collapse Dialog Box button located to the right of the argument text box) to restore the Function Arguments dialog box to its original size.

As you define arguments for a function in the Function Arguments dialog box, Excel shows you the calculated result following the heading, “Formula result =” near the bottom of the Function Arguments dialog box. When you finish entering the required argument(s) for your function (and any optional arguments that may pertain to your calculation), click OK to have Excel close the Function Arguments dialog box and insert the function into the formula.

TIP For details on how to use different types of built-in functions for your worksheets, refer to the following chapters in Book 3 that discuss the use of various categories: Chapter 2 for information on Logical functions; Chapter 3 for Date and Time functions; Chapter 4 for Financial functions; Chapter 5 for Math and Statistical functions; and Chapter 6 for Lookup, Information, and Text functions.

Copying Formulas

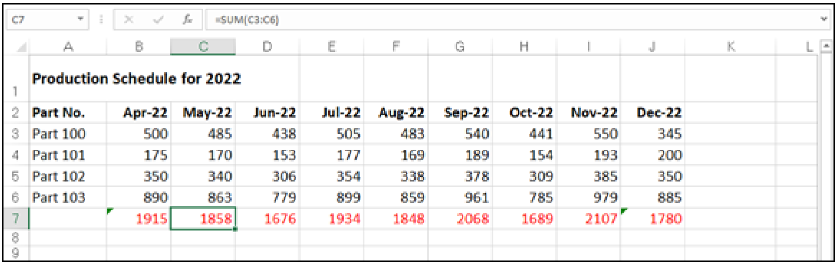
Copying formulas is one of the most common tasks that you do in a typical worksheet that relies primarily on formulas. Although most copy operations for formulas are straightforward, you need to exercise a bit of care to make sure that the copied formula is performing the calculation you want. The next few sections explain what I mean.

Copying with relative cell references

When a formula uses cell references rather than constant values (as nearly all formulas should), Excel makes the task of copying most formulas straightforward. (To find out why I added the hedge word "most" in that last sentence, see "Copying with absolute references," next.) The program does this by automatically adjusting the cell references in the original formula to suit the position of the copies that you make. It does this through a system known as *relative cell addresses,* where the column references in the cell address in the formula change to suit their new column position and the row references change to suit their new row position.

Figures 1-10 and 1-11 (sample workbook for both: Production Schedule 2022.xlsx) illustrate how this works. For Figure 1-10, I used the AutoSum button in cell B7 to build the original formula that uses the SUM function that totals the April sales. The formula in cell B7 reads

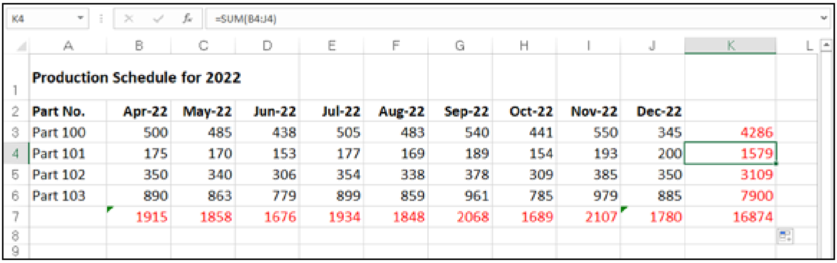
```
=SUM(B3:B6)
```



C7 =SUM(C3:C6)

	A	B	C	D	E	F	G	H	I	J	K	L
1	Production Schedule for 2022											
2	Part No.	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22		
3	Part 100	500	485	438	505	483	540	441	550	345		
4	Part 101	175	170	153	177	169	189	154	193	200		
5	Part 102	350	340	306	354	338	378	309	385	350		
6	Part 103	890	863	779	899	859	961	785	979	885		
7		1915	1858	1676	1934	1848	2068	1689	2107	1780		
8												
9												

FIGURE 1-10: An original formula copied with the Fill handle across the last row of the data. (Sample workbook: Production Schedule 2022.xlsx)



K4 =SUM(B4:J4)

	A	B	C	D	E	F	G	H	I	J	K	L
1	Production Schedule for 2022											
2	Part No.	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22		
3	Part 100	500	485	438	505	483	540	441	550	345	4286	
4	Part 101	175	170	153	177	169	189	154	193	200	1579	
5	Part 102	350	340	306	354	338	378	309	385	350	3109	
6	Part 103	890	863	779	899	859	961	785	979	885	7900	
7		1915	1858	1676	1934	1848	2068	1689	2107	1780	16874	
8												
9												

FIGURE 1-11: An original formula copied with the Fill handle down the last column of the data. (Sample workbook: Production Schedule 2022.xlsx)

I then used the AutoFill feature to copy this formula by dragging the Fill handle to include the cell range B7:J7. (Copying the formula with the cut-and-paste method would work just as well, although it’s a little more work.) Note in the cell range C7:J7 that Excel did not copy the original formula to the other cells verbatim. (Otherwise, each of the copied formulas would return the same result, 1915, as the original in cell B7.) If you look at the Formula bar in Figure 1-10, you see that the copy of the original formula in cell C7 reads

```
=SUM(C3:C6)
```

In this copy, Excel adjusted the column reference of the range being summed from B to C to suit the new position of the copy. Figure 1-11 shows how this works when copying an original formula in the other direction, this time down a column. For this figure, I used the AutoSum button to create a SUM formula that totals all the monthly sales for Part 100 in row 3. The formula in cell K3 reads

```
=SUM(B3:J3)
```

You can then use the Fill handle to copy this formula down the last column of the table to include the cell range by positioning the cell cursor in K3 and then dragging the Fill handle down to select K3:K7. If you were to then position the cell cursor in cell K4, you would see on the Formula bar that when Excel copied the original formula in cell K3 down to cell K4, it automatically adjusted the row reference to suit its new position so that the formula in cell K4 reads

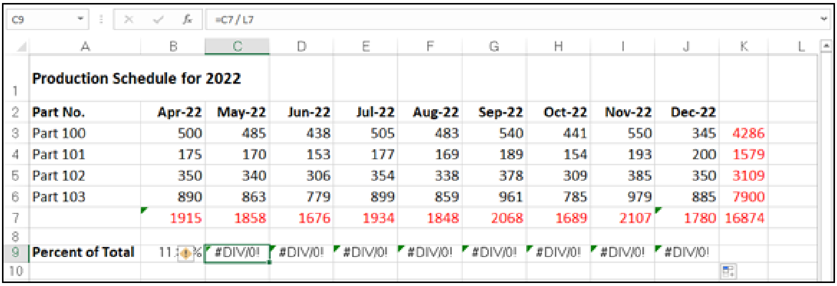
```
=SUM(B4:J4)
```

Copying with absolute references

Most of the time, relative cell references are exactly what you need in your formulas to enable Excel to adjust the row and/or column references during copying. However, you'll encounter some situations where Excel should not adjust one or more parts of the cell reference in the copied formula. The most common case is when you want to use a cell value as a constant in all the copies that you make of a formula.

Figure 1-12 (sample workbook: Production Schedule 2022.xlsx) illustrates just such a situation. In this situation, you want to build a formula in cell B9 that calculates what percentage April's part production total (B7) is of the total nine-month production (cell K7). Normally, you would create the following formula in cell B9 with all its relative cell references:

```
=B7 / K7
```



	A	B	C	D	E	F	G	H	I	J	K	L
1	**Production Schedule for 2022**											
2	**Part No.**	**Apr-22**	**May-22**	**Jun-22**	**Jul-22**	**Aug-22**	**Sep-22**	**Oct-22**	**Nov-22**	**Dec-22**		
3	Part 100	500	485	438	505	483	540	441	550	345	4286	
4	Part 101	175	170	153	177	169	189	154	193	200	1579	
5	Part 102	350	340	306	354	338	378	309	385	350	3109	
6	Part 103	890	863	779	899	859	961	785	979	885	7900	
7		1915	1858	1676	1934	1848	2068	1689	2107	1780	16874	
8												
9	**Percent of Total**	11.[illegible]%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!		
10												

FIGURE 1-12: Copying the formula in cell B9 across produces #DIV/0! errors in the cells C9:J9. (Sample workbook: Production Schedule 2022.xlsx)

However, when you copy this formula across to the range C9:J9 to calculate the percentages for the other eight months (May through December), look what happens: all those cells now show #DIV/0!, an Excel formula error that means division by zero (which is a no-no).

What happened? You can start to understand the problem by thinking about copying the original formula from cell B9 to C9 to calculate the percentage for May. In this cell, you want the following formula that divides the May production total in cell C7 by the nine-month total in cell K7:

```
=C7 / K7
```

However, if you don't indicate otherwise, Excel adjusts both parts of the formula in the copies, so that C9 incorrectly contains the following formula:

```
=C7 / L7
```

Because cell L7 is currently blank and blank cells have the equivalent of the value 0, this formula returns the #DIV/0! formula error as the result, thus indicating that Excel can't properly perform this arithmetic operation. (See Book 3, Chapter 2 for details on this error message.)

To indicate that you don't want a particular cell reference (such as cell K7 in the example) to be adjusted in the copies that you make of a formula, you change the cell reference from a relative cell reference to an *absolute cell reference.* An absolute cell reference contains dollar signs before the column letter and the row number, as in $K$7.

If you realize that you need to convert a relative cell reference to an absolute reference as you're building the original formula, you can convert the relative reference to absolute by selecting the cell and then pressing F4. To get an idea of how this works, follow along with these steps for creating the correct formula =B7 / $K$7 in cell B9:

1. **Click cell B9 to make it active.**
2. **Type = to start the formula; then click cell B7 and type / (the sign for division).**

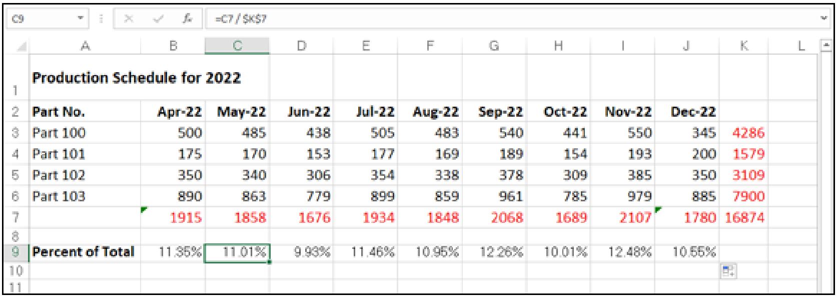
   The Formula bar now reads =B7/.
3. **Click K7 to select this cell and add it to the formula.**

   The Formula bar now reads =B7/K7.
4. **Press F4 once to change the cell reference from relative (K7) to absolute ($K$7).**

   The Formula bar now reads =B7/$K$7. You're now ready to enter the formula and then make the copies.

5. **Click the Enter button on the Formula bar and then drag the Fill handle to cell J9 before you release the mouse button.**

   Figure 1-13 (sample workbook: Production Schedule 2022.xlsx) shows the (now correct) results.



C9

`=C7 / $K$7`

	A	B	C	D	E	F	G	H	I	J	K	L
1	**Production Schedule for 2022**											
2	**Part No.**	**Apr-22**	**May-22**	**Jun-22**	**Jul-22**	**Aug-22**	**Sep-22**	**Oct-22**	**Nov-22**	**Dec-22**		
3	Part 100	500	485	438	505	483	540	441	550	345	4286	
4	Part 101	175	170	153	177	169	189	154	193	200	1579	
5	Part 102	350	340	306	354	338	378	309	385	350	3109	
6	Part 103	890	863	779	899	859	961	785	979	885	7900	
7		1915	1858	1676	1934	1848	2068	1689	2107	1780	16874	
8												
9	**Percent of Total**	11.35%	11.01%	9.93%	11.46%	10.95%	12.26%	10.01%	12.48%	10.55%		
10												
11												

FIGURE 1-13: Using an absolute cell reference in the divisor gets rid of the error and produces the correct results. (Sample workbook: Production Schedule 2022.xlsx)

Like it or not, you won't always anticipate the need for an absolute value until after you've built the formula and copied it to a range. When this happens, you have to edit the original formula, change the relative reference to absolute, and then make the copies again.

When editing the cell reference in the formula, you can change its reference by positioning the insertion point anywhere in its address and then pressing F4. You can also do this by inserting dollar signs in front of the column letter(s) and row number when editing the formula, although doing that isn't nearly as easy as pressing F4.

TIP

You can make an exact copy of a formula in another cell without using absolute references. To do this, make the cell with the formula that you want to copy the active one, use the I-beam pointer to select the entire formula in the Formula bar by dragging through it, and then click the Copy command button on the Ribbon's Home tab (or press Ctrl+C). Next, click the Cancel button to deactivate the Formula bar, select the cell where you want the exact copy to appear, and then click the Paste command button on the Home tab (or press Ctrl+V). Excel then pastes an exact duplicate of the original formula into the active cell without adjusting any of its cell references (even if they are all relative cell references).

REMEMBER When using the sum options on the Totals tab of the Quick Analysis tool's palette (see "Using Quick Analysis to add numbers" earlier in this chapter for details) all the cell references in the total and sum formulas that Excel creates are relative references.

TIP If you're building a formula that requires an absolute or some sort of mixed cell reference (see the following section) on a touchscreen device and using the Touch keyboard with no access to function keys, you need to add the required dollar sign(s) into the formula on the Formula bar by using the dollar sign ($) key on the Touch keyboard. To access the dollar sign key, tap the Numeric key (&123) to switch the Touch keyboard out of the QWERTY letter arrangement.

Copying with mixed cell references

Some formulas don't require you to change the entire cell reference from relative to absolute to copy them correctly. In some situations, you need to indicate only that the column letter or the row number remains unchanged in all copies of the original formula. A cell reference that is part relative and part absolute is called a *mixed cell reference.*

A mixed cell reference has a dollar sign just in front of the column letter or row number that should not be adjusted in the copies. For example, $C10 adjusts row 10 in copies down the rows but leaves column C unchanged in all copies across columns to its right. Another example is C$10, which adjusts column C in copies to columns to the right but leaves row 10 unchanged in all copies down the rows. (For an example of using mixed cell references in a master formula, refer to the information on using the PMT Function in Book 3, Chapter 4.)

To change the cell reference that you select in a formula (by clicking the flashing insertion point somewhere in its column letter and row number) from relative to mixed, continue to press F4 until the type of mixed reference appears on the Formula bar. When the Formula bar is active and the insertion point is somewhere in the cell reference (either when building or editing the formula), pressing F4 cycles through each cell-reference possibility in the following order:

- The first time you press F4, Excel changes the relative cell reference to absolute (C10 to $C$10).
- The second time you press F4, Excel changes the absolute reference to a mixed reference where the column is relative and the row is absolute ($C$10 to C$10).
- The third time you select the Reference command, Excel changes the mixed reference where the column is relative and the row is absolute to a mixed reference where the row is relative and the column is absolute (C$10 to $C10).
- The fourth time you press F4, Excel changes the mixed reference where the row is relative and the column is absolute back to a relative reference ($C10 to C10).

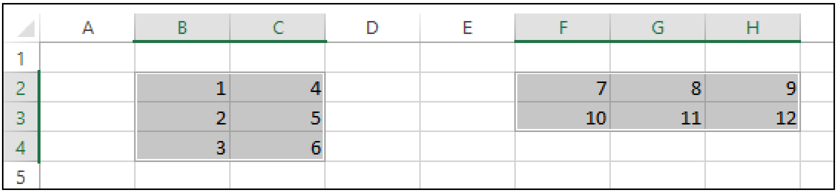
If you bypass the type of cell reference that you want to use, you can return to it by continuing to press F4 until you cycle through the variations again to reach the one that you need.

Adding Array Formulas

As noted previously in this chapter, many worksheet tables use an original formula that you copy to adjacent cells by using relative cell references (sometimes referred to as a *one-to-many copy*). In some cases, you can build the original formula so that Excel performs the desired calculation not only in the active cell, but also in all the other cells to which you would normally copy the formula. You do this by creating an *array formula.* An array formula is a special formula that operates on a collection of values. If a cell range supplies this collection (as is often the case), it’s referred to as an *array range.* If this range is supplied by a list of numerical values, they’re known as an *array constant.*

Although the array concept may seem foreign at first, you're already familiar with arrays because the column-and-row structure of the Excel worksheet grid naturally organizes your data ranges into one-dimensional and two-dimensional arrays. (1-D arrays take up a single row or column, whereas 2-D arrays take up multiple rows and columns.)

Figure 1-14 illustrates a couple of two-dimensional arrays with numerical entries of two different sizes. The first array is a 3 x 2 array in the cell range B2:C4. This array is a 3 x 2 array because it occupies three rows and two columns. The second array is a 2 x 3 array in the cell range F2:H3. This array is a 2 x 3 array because it uses two rows and three columns.



	A	B	C	D	E	F	G	H
1								
2		1	4			7	8	9
3		2	5			10	11	12
4		3	6					
5								

FIGURE 1-14: A worksheet with two different sizes of arrays.

If you were to list the values in the first 3 x 2 array as an array constant in a formula, they would appear as follows:

```
{1,4;2,5;3,6}
```

Several things in this list are noteworthy. First, the array constant is enclosed in a pair of braces ({}). Second, columns within each row are separated by commas (,) and rows within the array are separated by semicolons (;). Third, the constants in the array are listed across each row and then down each column and *not* down each column and across each row.

The second 2 x 3 array expressed as an array constant appears as follows:

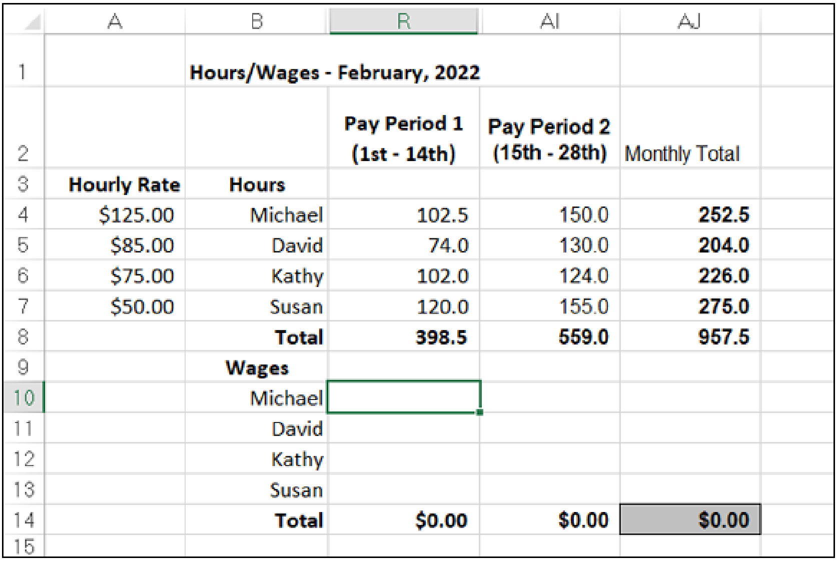
```
{7,8,9;10,11,12}
```

Note again that you list the values across each row and then down each column, separating the values in different columns with commas and the values in different rows with a semicolon.

Using array formulas can significantly reduce the amount of formula copying that you have to do in a worksheet by producing multiple results throughout the array range in a single operation. Also, array formulas use less computer memory than standard formulas copied in a range. This can be important when creating a large worksheet with many tables because it may mean the difference between fitting all your calculations on one worksheet and having to split your model into several worksheet files.

Creating an array formula

To get an idea of how you build and use array formulas in a worksheet, consider the sample worksheet shown in Figure 1-15 (sample workbook: Wages 02-22.xlsx). This worksheet is designed to compute the biweekly wages for each employee. It does this by multiplying each employee's hourly rate by the number of hours worked in each pay period.



	A	B	R	AI	AJ
1		**Hours/Wages - February, 2022**			
2			**Pay Period 1 (1st - 14th)**	**Pay Period 2 (15th - 28th)**	Monthly Total
3	**Hourly Rate**	**Hours**			
4	$125.00	Michael	102.5	150.0	**252.5**
5	$85.00	David	74.0	130.0	**204.0**
6	$75.00	Kathy	102.0	124.0	**226.0**
7	$50.00	Susan	120.0	155.0	**275.0**
8		**Total**	**398.5**	**559.0**	**957.5**
9		**Wages**			
10		Michael			
11		David			
12		Kathy			
13		Susan			
14		**Total**	**$0.00**	**$0.00**	**$0.00**
15					

FIGURE 1-15: The goal: to calculate each employee's hourly wages for the first pay period. (Sample workbook: Wages 02-22.xlsx)

One way to make these calculations would be to create the following formula in cell R10 and then copy the formula down the cells R11 through R13:

```
=A4 * R4
```

That works, but having to copy the formula is an extra step that can be a pain if you have a ton of copies to make. Instead, you can skip the copying step altogether by adding the following array formula in the array range (R10:R13):

```
=A4:A7 * R4:R7
```

This array formula multiplies each of the hourly rates in the 4 x 1 array in the range A4:A7 with the corresponding number of hours worked in the 4 x 1 array in the range R4:R7. This same formula is entered into all cells of the array range (R10:R13) as soon as you complete the formula in the active cell R10.

WARNING This type of formula is known as a *dynamic array formula,* and it only works in Excel 2019 and later. If you need your array calculation to work in earlier versions of Excel, use the method I describe in the "Building old-fashioned array formulas" section.

Follow along with the steps required to build this array formula:

1. **Ensure that all the cells in the array range are empty.**

   In the example, you'd clear out the range R10:R13, if needed.

2. **Select the first cell in the array range and type an equal sign (=).**

   In the example, you'd make cell R10 the current cell.

3. **Enter your formula. When you come to an operand that would normally be a cell reference, enter a range reference that contains all the cells in the array.**

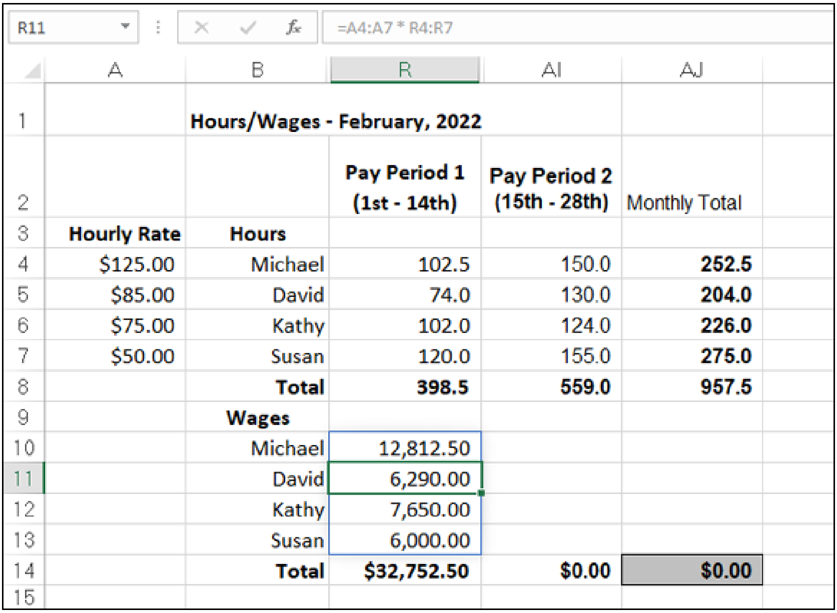
   In the example, you'd replace the cell reference A4 with the range reference A4:A7, and you'd replace the cell reference R4 with the range reference R4:R7. Your formula should now look like this:

   ```
   =A4:A7 * R4:R7
   ```

4. **Press Enter or click the Enter button in the**

Formula bar.

Presto! Excel adds the array formula not only to the current cell, but to all the cells in the array range, as shown in Figure 1-16 (sample workbook: Wages 02-22.xlsx). Here, I've selected cell R11 so you can see that, yep, Excel applies the same array formula to each cell of the array range (R10:R13).



`=A4:A7 * R4:R7`

	A	B	R	AI	AJ
1		**Hours/Wages - February, 2022**			
2			**Pay Period 1 (1st - 14th)**	**Pay Period 2 (15th - 28th)**	Monthly Total
3	**Hourly Rate**	**Hours**			
4	$125.00	Michael	102.5	150.0	**252.5**
5	$85.00	David	74.0	130.0	**204.0**
6	$75.00	Kathy	102.0	124.0	**226.0**
7	$50.00	Susan	120.0	155.0	**275.0**
8		**Total**	**398.5**	**559.0**	**957.5**
9		**Wages**			
10		Michael	12,812.50		
11		David	6,290.00		
12		Kathy	7,650.00		
13		Susan	6,000.00		
14		**Total**	**$32,752.50**	**$0.00**	**$0.00**
15					

FIGURE 1-16: An array formula makes short work of hourly wage calculation. (Sample workbook: Wages 02-22.xlsx)

REMEMBER The process where Excel automatically applies your array formula to the other cells in the range is known in Excel World as *spilling* the data and the range that gets filled in is called the *spill range*.

You can use array formulas to complete the rest of the February wage table. In the second cell range, AI10:AI13, you'd enter the following array formula to calculate the hourly wages for the second pay period in February:

```
=A4:A7 * AI4:AI7
```

In the third cell range, AJ10:AJ13, you'd enter the following array formula to calculate the total wages paid to each employee in February 2022:

```
=R10:R13 + AI10:AI13
```

Editing a dynamic array formula

Although it appears in Figure 1-16 that the dynamic array formula now resides in cell R11, that's not quite the case. Excel *applies* the formula to that cell (as well as to cells R12 and R13), but the formula that you see in R11 is only a virtual copy. The actual formula only resides in the cell where you entered the formula (R10, in the example).

Therefore, when you need to edit the array formula, you must first select the same cell that you used to enter the array formula. When you finish your edit and press Enter or click the Enter button, Excel propagates the changes to the rest of the array range.

Building old-fashioned array formulas

I mentioned earlier that Excel's newfangled dynamic arrays only work with Excel 2019 and later. If you need to keep your worksheets compatible with previous versions of Excel, you can use Excel’s old method for building arrays. Going back to the example worksheet shown in Figure 1-15, you can create the following array formula in the array range:

```
={A4:A7 * R4:R7}
```

This array formula looks (and works) just like its dynamic cousin, except that it has those curly brackets — they're called *braces* — surrounding everything that comes after the equal sign (=).

To see how you create this version of the array formula, follow along with these steps:

1. **Make cell R10 the current cell, and then select the array range R10:R13 and type = (equal sign) to start the array formula.**

   You always start an array formula by selecting the cell or cell range where the results are to appear. Note that array formulas, like standard formulas, begin with the equal sign.

2. **Select the range A4:A7 that contains the hourly rate for each employee as shown, type an * (asterisk for multiplication), and then select the range R4:R7 that contains the total number of hours worked during the first pay period.**
3. **Press Ctrl + Shift + Enter to insert an array formula in the array range.**

   When you press Ctrl + Shift + Enter to complete the formula, Excel inserts braces around the formula and copies the array formula {=A4:A7 * R4:R7} into each of the cells in the array range R10:R13.

WARNING When entering an old-style array formula, you must press Ctrl + Shift + Enter instead of just the Enter key because this special key combination tells Excel that you are building an older array formula, so that the program encloses the formula in braces and copies it to every cell in the array range. Also, don't try to create this type of array formula by editing it on the Formula bar and then insert curly braces because this doesn't cut it. The only way to create an old-fashioned array formula is by pressing Ctrl + Shift + Enter to complete the formula entry.

WARNING When you enter an old-style array formula, the formula should produce an array with the same dimensions as the array range that you selected. If the resulting array returned by the formula is smaller than the array range, Excel expands the resulting array to fill the range. If the resulting array is larger than the array range, Excel doesn't display all the results. When expanding the results in an array range, Excel considers the dimensions of all the arrays used in the arguments of the operation. Each argument must have the same number of rows as the array with the most rows and the same number of columns as the array with the most columns.

Editing an old-fashioned array formula

Editing old-style array formulas differs somewhat from editing normal formulas. In editing an array range, you must treat the range as a single unit and edit it in one operation (corresponding to the way in which the array formula was entered). This means that you can't edit, clear, move, insert, or delete individual cells in the array range. If you try, Excel displays an Alert dialog box stating "You cannot change part of an array."

To edit the contents of an array formula, select a cell in the array range and then activate Edit mode by clicking inside the Formula bar or by pressing F2. When you do this, Excel displays the contents of the array formula without the customary braces. The program also outlines the ranges referred to in the array formula in the cells of the worksheet in different colors that match those assigned to the range addresses in the edited formula on the Formula bar. After you make your changes to the formula contents, you must remember to press Ctrl + Shift + Enter to enter your changes and have Excel enclose the array formula in braces once again.

If you want to convert the results in an array range to their calculated values, select the array range and click the Copy button on the Ribbon's Home tab or press Ctrl + C. Then, without changing the selection, click the Paste Values option from the Paste button's drop-down menu (or press Alt + HVV). As soon as you convert an array range to its calculated values, Excel no longer treats the cell range as an array.

Naming Cells and Ranges

Thus far, all the example formulas in this chapter have used a combination of numerical constants, cell references (both relative and absolute), and range references. Although cell and range references provide a convenient method for pointing out the cell location in the worksheet grid, they're not at all descriptive of their content or function when used in formulas. Fortunately, Excel enables you to assign descriptive names to worksheet cells and ranges. Adding such names makes your worksheet formulas immediately more readable by showing the content or function of the cell and range operands.

To get an idea of how names can help to document the purpose of a formula, consider the following formula:

```
=B4 * B2
```

It's a legit formula, but what does it do? It's impossible to say without examining the worksheet in more detail to look for clues.

Now check out the following formula that performs the same calculation but, this time, with the use of names:

```
=Retail_Price * Discount_Rate
```

Ah, that's better: Just by looking at the formula, you can deduce that it's a calculation for determining the sale price of an item. Now the function of the formula is much more comprehensible, not only to you as the creator of the worksheet but also to anyone else who has to use it.

TIP Names are extremely useful not only for documenting the function of the formulas in your worksheet, but also for finding and selecting cell ranges quickly and easily. This is especially helpful in a large worksheet that you aren't very familiar with or only use intermittently. After you assign a name to a range, you can locate and select all the cells in that range with the Go To dialog box. On the Ribbon's Home tab, drop down the Find & Select list and click Go To (or press Ctrl+G or F5). Then double-click the name in the Go To list box or click the name and click OK. Excel then selects the entire range and, if necessary, shifts the worksheet display so that you can see the first cell in that range on the screen.

TIP If you're using Excel on a Windows device such as a tablet without the benefit of a keyboard or mouse, you will definitely find it to your advantage to assign names to often-used cell ranges in your worksheets. That way, you can go to and select these ranges by tapping the Name box drop-down button followed by the name. That's so much faster and easier than manually finding and selecting the range with your finger or stylus.

Defining cell and range names

The most straightforward way to define a name is to follow these steps:

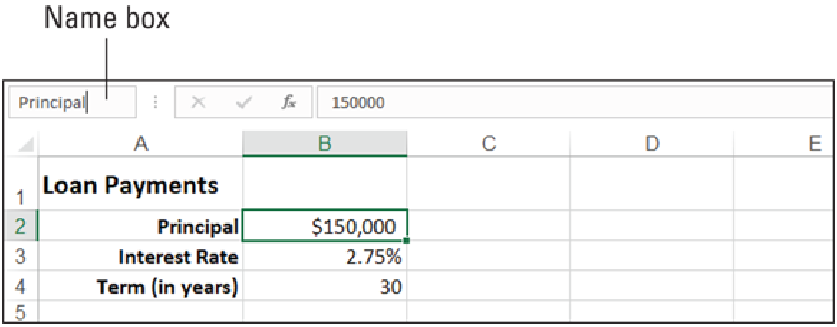
1. **Select the worksheet area you want to name.**

   You can select a cell, a range, or a collection of nonadjacent cells.

2. **Use the Formula bar's Name box to type the name you want to assign to the selection.**

   See Figure 1-17 (sample workbook: Loan Payments.xlsx).

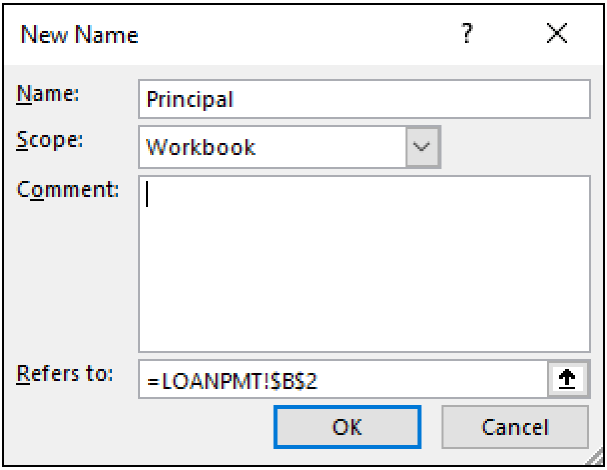
3. **Press Enter.**



	A	B	C	D	E
1	Loan Payments				
2	Principal	$150,000			
3	Interest Rate	2.75%			
4	Term (in years)	30			
5					

FIGURE 1-17: You can define a name using the Formula bar's Name box. (Sample workbook: Loan Payments.xlsx)

You can also name a cell, cell range, or nonadjacent selection by displaying the Ribbon’s Formulas tab and clicking the Define Name command (or by pressing Alt+MMD). Excel opens the New Name dialog box, as shown in Figure 1-18, where you can type the selection’s name in the Name text box. If Excel can identify a label in the cell immediately above or to the left of the active one, the program inserts this label as the suggested name in the Name text box.



Name: Principal

Scope: Workbook

Refers to: =LOANPMT!$B$2

FIGURE 1-18: You can use the New Name dialog box to define a new name.

The New Name dialog box also displays the scope of the name in the Scope drop-down list box. The *scope* tells you where the name is recognized by Excel. Workbook scope means you can use the name anywhere in the current workbook; worksheet scope means you can only use the name within the specified worksheet.

The New Name dialog box also displays the reference of the selected cell or range (expressed as absolute references) in the Refers To text box below.

You can do the following:

- To change the scope from the entire workbook to a particular worksheet in the workbook so that the name is only recognized on that sheet, select the sheet's name from the Scope drop-down list.
- To change the cell or range the name refers to, click inside the Refers To box and then select the new cell or range in the worksheet. (Remember that you can collapse the New Name dialog box to the Refers To text box by clicking its Collapse button.)
- If you have similar names or names that require some elaboration, use the Comment box to add some descriptive text. You see these comments in the Name Manager, which I describe a bit later (see "Managing names").

When you're done, click OK to define the name.

REMEMBER When naming a range, you need to follow the same naming conventions as when defining a name in the Name box on the Formula bar. Basically, this means that the name must begin with a letter rather than a number, contain no spaces, and not duplicate any other name in the workbook. (See Book 2, Chapter 2 for more on naming ranges.)

If you want to assign the same name to similar ranges on different worksheets in the workbook, you have two choices:

- For each worksheet, create the named range and scope the name to that worksheet.
- Preface the name with the sheet name followed by an exclamation point and then the descriptive name. For example, if you want to give the name Costs to the cell range A2:A10 on both Sheet1 and Sheet2, you name the range Sheet1!Costs on Sheet1 and Sheet2!Costs on Sheet2. If you have renamed the worksheet to something more descriptive than Sheet1, you need to enclose the name in single quotes if it contains a space when you enter the range. For example, if you rename Sheet1 to Income Statement 2022, you enter the name including the worksheet reference for the Costs cell range as follows:

```
'Income Statement 2022'!Costs
```

TIP When you preface a name with the sheet name as shown in this example, you don't have to use the sheet name part of the name in the formulas that you create on the same worksheet. In other words, if you create a SUM formula that totals the values in the 'Income Statement 2022'!Costs range somewhere on the Income Statement 2022 worksheet, you can enter the formulas as follows:

```
=SUM(Costs)
```

However, if you were to create this formula on any other worksheet in the workbook, you would have to include the full name in the formula, as in

```
=SUM('Income Statement 2022'!Costs)
```

Naming constants and formulas

Besides naming cells and ranges in your worksheet, you can also assign names to the constants and formulas that you use often. For example, if you're creating a worksheet table that calculates sales prices, you can assign the discount percentage rate to the name discount_rate. Then, you can supply this name as a constant in any formula that calculates the sale discount used in determining the sale price for merchandise.

For example, to assign a constant value of 15% to the name discount_rate, you open the New Name dialog box, type **discount_rate** in the Name text box, type =**15%** (that's the value of the discount rate) in the Refers To text, and then click OK. After assigning this constant percentage rate to the name discount_rate in this manner, you can apply it to any formula by typing or pasting in the name. (See the "Using names in building formulas" section that follows in this chapter for details.)

In addition to naming constants, you can also give a name to a formula that you use repeatedly. When building a formula in the Refers To text box of the New Name dialog box (Alt+MMD), keep in mind that Excel automatically applies absolute references to any cells that you point to in the worksheet. If you want to create a formula with relative cell references that Excel adjusts when you enter or paste the name in a new cell, you must press F4 to convert the current cell reference to relative or type in the cell address without dollar signs.

WARNING When creating the constant in the New Name dialog box, don't change the Scope setting from Workbook to a particular sheet in the workbook unless you're positive that you'll never need to use that constant in a formula on any other worksheet. If you limit the scope to a particular worksheet, Excel doesn't let you use the name in a formula on any other worksheet (you'll get the #NAME? error), and Scope is the one aspect you can't change when editing a name via the Name Manager. (I discuss managing names later in this chapter.)

Using names in building formulas

After you assign a name to a cell or range in your worksheet, you can then click the name from the Use in Formula button's drop-down menu on the Ribbon's Formulas tab to paste it into the formulas that you build (Alt+MS).

For example, in the sample Autumn 2022 Furniture Sale table shown in Figure 1-19, after assigning the discount rate of 15% to the name, discount_rate, you can create the formulas that calculate the amount of the sale discount. To do this, you multiply the retail price of each item by the discount_rate constant using the Use in Formula command button by following these steps:

1. **Make cell D3 active.**
2. **Type = (equal sign) to start the formula.**
3. **Click cell C3 to select the retail price for the first item and then type * (asterisk).**

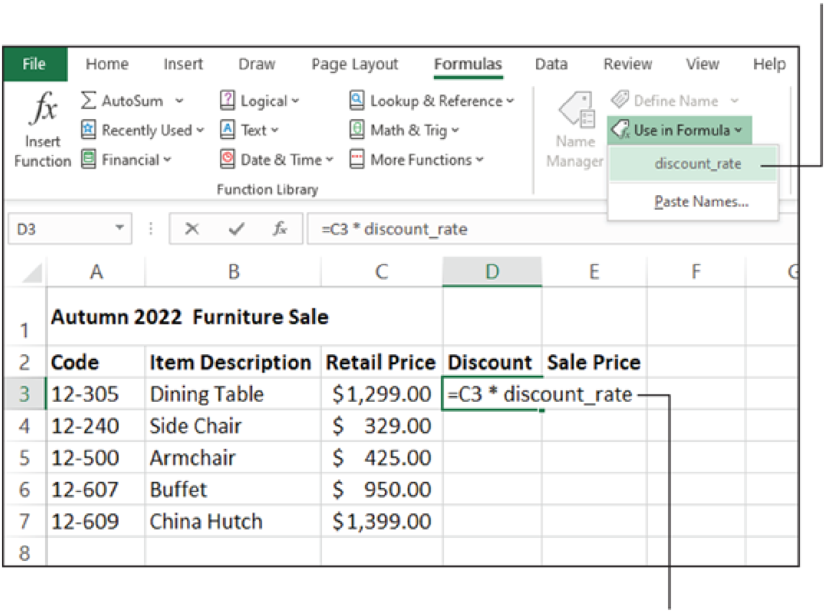
   The formula on the Formula bar now reads, =C3*.
4. **On the Ribbon's Formulas tab, click the Use in Formula button (or press Alt+MS).**

   Excel opens the Use in Formula drop-down menu, which lists your defined range names.
5. **Click the name discount_rate.**

   The formula now reads =C3*discount_rate, as shown in Figure 1-19 (sample workbook: Autumn Furniture Sale 2022.xlsx).
6. **Click the Enter button on the Formula bar to input the formula in cell D3.**

   Now, all that remains is to copy the original formula down column D.
7. **Drag the Fill handle in cell D3 down to cell D7 and release the mouse button to copy the formula and calculate the discount for the entire table.**

Click the name here…


File
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Help
Insert Function
AutoSum
Recently Used
Financial
Logical
Text
Date & Time
Lookup & Reference
Math & Trig
More Functions
Function Library
Name Manager
Define Name
Use in Formula
discount_rate
Paste Names…
D3
A
B
C
D
E
F
G

=C3 * discount_rate

	A	B	C	D	E
1	**Autumn 2022 Furniture Sale**				
2	**Code**	**Item Description**	**Retail Price**	**Discount**	**Sale Price**
3	12-305	Dining Table	$1,299.00	=C3 * discount_rate	
4	12-240	Side Chair	$ 329.00		
5	12-500	Armchair	$ 425.00		
6	12-607	Buffet	$ 950.00		
7	12-609	China Hutch	$1,399.00		
8					

…and Excel pastes the name here.

FIGURE 1-19: In the Use in Formula list, click the name you want to paste into your formula (such as the name discount_rate). (Sample workbook: Autumn Furniture Sale 2022.xlsx)

Creating names from column and row headings

In the Ribbon's Formulas tab, you can use the Create from Selection command to automatically create column and row names from the existing column and row headings in a table of data. Create from Selection defines column names from the labels used as column headings in the top or bottom row of the table, the row names from the labels used as row headings in the leftmost or rightmost column, or any combination of these headings.

For example, the sample worksheet in Figure 1-20 illustrates a typical data layout that uses column headings in the top row of the data and row headings in the first column of the data. You can assign these labels to the rows and columns in the data by using the Create from Selection command button as follows:

1. **Select the data cells, including those with the column and row labels that you want to use as**

names.

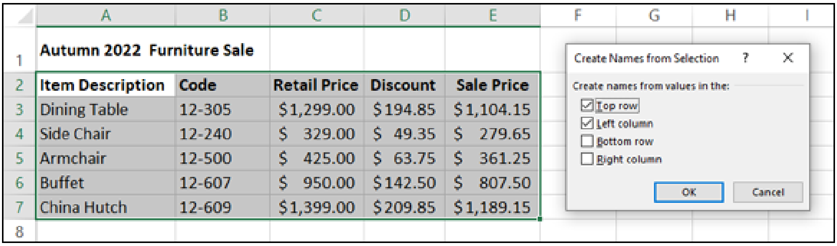
For the example shown in Figure 1-20, you select the range A2:E7.

2. **On the Formulas tab, click the Create from Selection command (Alt+MC).**

   Excel opens the Create Names from Selection dialog box that contains four check boxes: Top Row, Left Column, Bottom Row, and Right Column. The program selects the check box or boxes in this dialog box based on the arrangement of the labels in your data. In the example shown in Figure 1-20 (sample workbook: Autumn Furniture Sale 2022.xlsx), Excel selects both the Top Row and Left Column check boxes because the data contains both column headings in the top row and row headings in the left column.

3. **If necessary, select the check boxes that correspond to the layout of your data.**

4. **Click OK to assign the names to your data.**



	A	B	C	D	E
1	**Autumn 2022 Furniture Sale**				
2	**Item Description**	**Code**	**Retail Price**	**Discount**	**Sale Price**
3	Dining Table	12-305	$1,299.00	$194.85	$1,104.15
4	Side Chair	12-240	$ 329.00	$ 49.35	$ 279.65
5	Armchair	12-500	$ 425.00	$ 63.75	$ 361.25
6	Buffet	12-607	$ 950.00	$142.50	$ 807.50
7	China Hutch	12-609	$1,399.00	$209.85	$1,189.15
8					

Create Names from Selection

Create names from values in the:

☑ Top row

☑ Left column

☐ Bottom row

☐ Right column

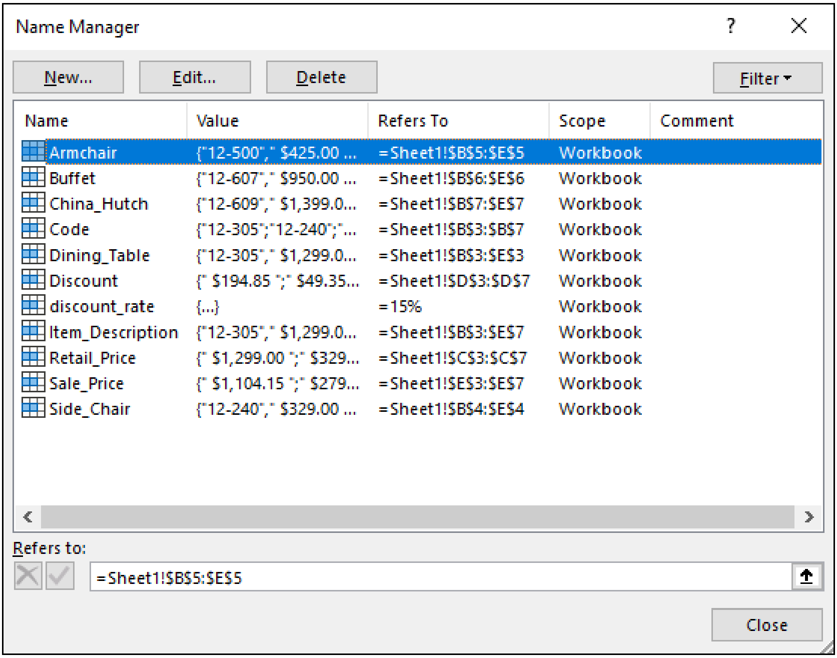
FIGURE 1-20: Creating names from the row and column headings in a worksheet data range. (Sample workbook: Autumn Furniture Sale 2022.xlsx)

Note that when you select both the Top Row and Left Column check boxes in the Create Names from Selection dialog box, Excel assigns the label in the cell in the upper-left corner of the range to the data portion of the range you selected (that is, the part of the range that doesn't include the row and column headings). In the example illustrated in Figure 1-20, Excel assigns the name Item:Description (the heading for column A) to the cell range B3:E7.

Excel also defines each column heading as the name of that column's data. For example, Excel assigns the name Retail_Price to the cell range C3:C7. Similarly, Excel defines each row heading as the name of that row's data. For example, Excel assigns the name China_Hutch to the cell range B7:E7.

Managing names

As you assign names in your workbook, their names appear in the Name Manager dialog box (see Figure 1-21.) You open this dialog box by displaying the Formulas tab and clicking the Name Manager command (or by pressing Alt+MN).



Name	Value	Refers To	Scope	Comment
Armchair	{"12-500"," $425.00 ...	=Sheet1!$B$5:$E$5	Workbook	
Buffet	{"12-607"," $950.00 ...	=Sheet1!$B$6:$E$6	Workbook	
China_Hutch	{"12-609"," $1,399.0...	=Sheet1!$B$7:$E$7	Workbook	
Code	{"12-305";"12-240";"...	=Sheet1!$B$3:$B$7	Workbook	
Dining_Table	{"12-305"," $1,299.0...	=Sheet1!$B$3:$E$3	Workbook	
Discount	{" $194.85 ";" $49.35...	=Sheet1!$D$3:$D$7	Workbook	
discount_rate	{...}	=15%	Workbook	
Item_Description	{"12-305"," $1,299.0...	=Sheet1!$B$3:$E$7	Workbook	
Retail_Price	{" $1,299.00 ";" $329...	=Sheet1!$C$3:$C$7	Workbook	
Sale_Price	{" $1,104.15 ";" $279...	=Sheet1!$E$3:$E$7	Workbook	
Side_Chair	{"12-240"," $329.00 ...	=Sheet1!$B$4:$E$4	Workbook	

Refers to:

=Sheet1!$B$5:$E$5

FIGURE 1-21: The Name Manager lists all names defined in the workbook.

The Name Manager enables you to do any of the following:

- **Define a new name:** Click New to open the New Name dialog box. (See "Defining cell and range names" earlier in this chapter.)
- **Edit an existing name:** Click the name you want to modify and then click Edit to open the Edit Name dialog box. Change the name, comment, or reference (but not the scope), and then click OK.

- **Delete an existing name:** Click the name and then click Delete. When Excel asks you to confirm the deletion, click OK.
- **Filter the names:** Click the Filter button and then click a filter option (Names Scoped to Worksheet, Names Scoped to Workbook, Names with Errors, Names without Errors, Defined Names, or Table Names) from its drop-down menu.

WARNING Be careful that you don’t delete a name that is already used in formulas in the worksheet. If you do, Excel returns the #NAME? error value to any formula that refers to the name you deleted!

Applying names to existing formulas

Excel doesn’t automatically replace cell or range references with the descriptive names that you assign to them in the New Name or Create Names from Selection dialog boxes. To replace cell or range references with their names, display the Formulas tab, drop down the Define Name list, and then click Apply Names (or press Alt+MMA).

When you choose this command, Excel opens the Apply Names dialog box, where you select the names that you want applied in formulas used in your worksheet by selecting the names in the Apply Names list box.

Note that when you first open this dialog box, it contains just two check boxes: Ignore Relative/Absolute and Use Row and Column Names (both of which are selected). You can click the Options button to expand the Apply Names dialog box and display other options that you can use when applying your names. The expanded Apply Names dialog box offers the following options:

- **Ignore Relative/Absolute:** The program replaces cell references with the names that you’ve selected in the Apply Names list box, regardless of the type of reference used in their formulas. If you want Excel to replace only those cell references that use the same type of references as are used in your names (absolute for absolute, mixed for mixed, and relative for relative), deselect this check box. Most of the time, you want to leave this check box selected because Excel automatically assigns absolute cell references to the names that you define and relative cell references to the formulas that you build.

- **Use Row and Column Names:** The names created from row and column headings with the Create Names command appear in your formulas. Deselect this option if you don't want these row and column names to appear in the formulas in your worksheet.

- **Omit Column Name If Same Column:** Prevents Excel from repeating the column name when the formula is in the same column. Deselect this check box when you want the program to display the column name even in formulas in the same column as the heading used to create the column name.

- **Omit Row Name If Same Row:** Prevents Excel from repeating the row name when the formula is in the same row. Deselect this check box when you want the program to display the row name even in formulas in the same row as the heading used to create the row name.

- **Name Order:** Click the Row Column option (the default) if you want the row name to precede the column name when both names are displayed in the formulas or click the Column Row option if you want the column name to precede the row name.

After applying all the names by using the default Apply Names options (that is, Ignore Relative/Absolute, Use Row and Column Names, Omit Column Name If Same Column, Omit Row Name If Same Row, and Name Order options selected), Excel replaces all the cell references in the formulas in the Sale Price table. In cell E3, for example, in place of the original formula, =C3–D3, the cell now contains the formula

```
=Retail_Price - Discount
```

Cell D3, to the immediate left, instead of =C3 * discount_rate now contains:

```
=Retail_Price * discount_rate
```

Only one problem occurs with applying names by using the default settings. This problem begins to show up as soon as you select cell E4. Although this formula subtracts cell D4 from C4, its contents now also appear as

```
=Retail_Price - Discount
```

This is identical in appearance to the contents of cell E3 above (and, in fact, identical in appearance to cells E5, E6, and E7 in the cells below).

The reason that the formulas all appear identical (although they're really not) is because the Omit Row Name If Same Row check box was selected when I applied the names to the formulas. With this setting selected, Excel doesn't bother to repeat the row name when the formula is in the same row.

When you deselect the Omit Row Name if Same Row check box while still selecting the Use Row and Column Name check box in the Apply Names dialog box, the formula in cell E3 would appear as follows:

```
=Dining_Table Retail_Price – Dining Table Discount
```

If you were then to select cell E4 below, the formula would now appear quite differently in this form:

```
=Side_Chair Retail_Price – Side_Chair Discount
```

Now Excel displays both the row and column names separated by a space for each cell reference in the formulas in this column. Remember that the space between the row name and column name is called the *intersection operator*. (Refer to Table 1-1.) You can interpret the formula in E3 as saying, "Take the cell at the intersection of the Table row and Retail_Price column and subtract it from the cell at the intersection of the Table row and Discount column." The formula in E4 is similar, except that it says, "Take the cell at the intersection of the Side_chair row and Retail_Price column and subtract it from the cell at the intersection of the Side_chair row and Discount column."

Adding Linking Formulas

Linking formulas are formulas that transfer a constant or other formula to a new place in the same worksheet, same workbook, or even a different workbook without copying it to its new location. When you create a linking formula, it brings forward the constant or original formula to a new location so that the result in the linking formula remains dynamically tied to the original. If you change the original constant or any of the cells referred to in the original formula, the result in the cell containing the linking formula is updated at the same time as the cell containing the original constant or formula.

You can create a linking formula in one of two ways:

- Select the cell where you want the linking formula, type = (equal sign), and then click the cell with the constant (text or number) or the formula that you want to bring forward to that cell. Complete the cell entry by clicking the Enter button on the Formula bar or pressing the Enter key.

- Select the cell with the constant or formula that you want to bring forward to a new location and then click the Home tab's Copy button or press Ctrl+C. Then click the cell where the linking formula is to appear, drop down the Home tab's Paste menu, and then click Paste Link (or press Alt+HVN).

When you use the first simple formula method to create a link, Excel uses a relative cell reference to refer to the cell containing the original value or formula (as in =A10 when referring to an entry in cell A10). However, when you use the second copy-and-paste link method, Excel uses an absolute cell reference to refer to the original cell (as in =$A $10 when referring to an entry in cell A10).

When you create a linking formula to a cell on a different sheet of the same workbook, Excel inserts the worksheet name (followed by an exclamation point) in front of the cell address. So, if you copy and paste a link to a formula in cell A10 on a different worksheet called Income 2022, Excel inserts the following linking formula:

```
='Income 2022!$A$10
```

When you create a linking formula to a cell in a different workbook, Excel inserts the workbook filename enclosed in square brackets before the name of the worksheet, which precedes the cell address. So, if you bring forward a formula in cell A10 on a worksheet called Cost Analysis in the Projected Income 2023 workbook, Excel inserts this linking formula:

```
='[Projected Income 2023.xlsx]Cost Analysis'!$A$10
```

If you ever need to sever a link between the cell containing the original value or formula and the cell to which it’s been brought forward, you can do so by editing the linking formula. Press F2, immediately recalculate the formula by pressing F9, and then click the Enter button on the Formula bar or press Enter. This replaces the linking formula with the currently calculated result. Because you’ve converted the dynamic formula into a constant, changes to the original cell no longer affect the one to which it was originally brought forward.

Controlling Formula Recalculation

Normally, Excel recalculates your worksheet automatically as soon you change any entries, formulas, or names on which your formulas depend. This system works fine as long as the worksheet isn't too large or doesn’t contain tables whose formulas depend on several values.

When Excel does calculate your worksheet, the program recalculates only those cells that are affected by the change that you’ve made. Nevertheless, in a complex worksheet that contains many formulas, recalculation may take several seconds. (During which time, the pointer changes to an hourglass, and the word “Recalculation” followed by the number of cells left to be recalculated appears on the left side of the Formula bar.)

Because Excel recalculates dependent formulas in the background, you can always interrupt this process and make a cell entry or click a command even when the pointer assumes the hourglass shape during the recalculation process. As soon as you stop making entries or selecting commands, Excel resumes recalculating the worksheet.

To switch to manual recalculation, display the Formulas tab, click Calculation Options, and then select the Manual option (or press Alt+MXM). After switching to manual recalculation, when you make a change in a value, formula, or name that would usually cause Excel to recalculate the worksheet, the program displays the message “Calculate” on the Status bar.

When you’re ready to have Excel recalculate the worksheet, display the Formulas tab and then click the Calculate Now command (the handheld calculator icon), or press F9 or Ctrl+=. This tells the program to recalculate all dependent formulas and open charts and makes the Calculate status indicator disappear from the Status bar.

REMEMBER After switching to manual recalculation, Excel still automatically recalculates the worksheet whenever you save the file. When you are working with a large and complex worksheet, recalculating the worksheet each time you want to save your changes can make this process quite time-consuming. If you want to save the worksheet without first updating dependent formulas and charts, choose File ⇒ Options to open the Excel Options dialog box, display the Formulas tab, and then deselect the Recalculate Workbook before Saving check box in the Calculation Options section.

TIP If your worksheet contains large data tables used to perform what-if analysis, you can bypass those data tables during Excel's automatic recalculations by displaying the Formulas tab, clicking Calculation Options, and then clicking Automatic Except Data Tables (or press Alt+MXE). You can now change a number of variables in the what-if formulas before having Excel recalculate the data table. (See Book 7, Chapter 1 for more on performing what-if analysis.)

Automatic, Automatic Except Data Tables, and Manual are by no means the only calculation options available in Excel. Table 1-3 explains each of the options that appear in the Calculation Options section of the Formulas tab of the Excel Options dialog box.

TABLE 1-3 The Calculation Options in Excel

Option	***Purpose***
Automatic	Calculates all dependent formulas and updates open or embedded charts every time you make a change to a value, formula, or name. This is the default setting for each new workbook that you start.
Automatic Except for Data Tables	Calculates all dependent formulas and updates open or embedded charts. Does not calculate data tables created with the Data Table feature. (See Book 7, Chapter 1, for information on creating data tables.) To recalculate data tables when this option button is selected, click the Formulas tab's Calculate Now command or press F9 in the worksheet.
Manual	Calculates open worksheets and updates open or embedded charts only when you click the Formulas tab's Calculate Now command button or press F9 or Ctrl+= in the worksheet.
Recalculate Workbook before Saving	When this check box is selected, Excel calculates open worksheets and updates open or embedded charts when you save them even when the Manually option button is selected.
Enable Iterative Calculation	When this check box is selected, Excel sets the *iterations,* that is, the number of times that a worksheet is recalculated, when performing goal seeking (see Book 7, Chapter 1) or resolving circular references to the number displayed in the Maximum Iterations text box.
Maximum Iterations	Sets the maximum number of iterations (100 by default) when the Iteration check box is selected.
Maximum Change	Sets the maximum amount of change to the values during each iteration (0.001 by default) when the Iteration check box is selected.

Circular References

A *circular reference* in a formula is one that depends, directly or indirectly, on its own value. The most common type of circular reference occurs when you mistakenly refer in the formula to the cell in which you’re building the formula itself. For example, suppose that cell B10 is active when you build this formula:

```
=A10 + B10
```

As soon as you click the Enter button on the Formula bar or press Enter or an arrow key to insert this formula in cell B10 (assuming the program is in Automatic recalculation mode), Excel displays an Alert dialog box, stating that it can’t calculate the formula due to the circular reference.

If you then press Enter or click OK to close this Alert dialog box, an Excel Help window appears containing general information about circular references in two sections: Locate and Remove a Circular Reference and Make a Circular Reference Work by Changing the Number of Times Microsoft Excel Iterates Formulas.

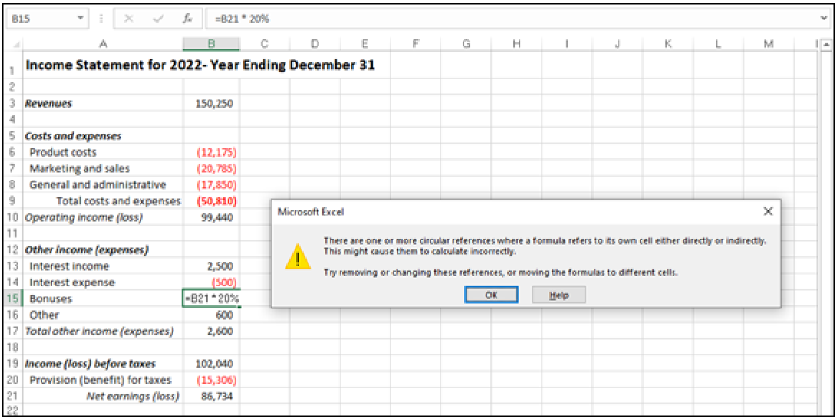
When you close this Excel Help window by clicking its Close button, Excel inserts 0 in the cell with the circular reference, and the Circular Reference status indicator followed by the cell address with the circular reference appears on the Status bar.

Some circular references are solvable by increasing the number of times they are recalculated (each recalculation bringing you closer and closer to the desired result), whereas others are not (for no amount of recalculating brings them closer to any resolution) and need to be removed from the worksheet.

The formula in cell B10 is an example of a circular reference that Excel is unable to resolve because the formula’s calculation depends directly on the formula’s result. Each time the formula returns a new result, this result is fed into the formula, thus creating a new result to be fed back into the formula. Because this type of circular reference sets up an endless loop that continuously requires recalculating and can never be resolved, you need to fix the formula reference or remove the formula from the worksheet.

Figure 1-22 illustrates the classic example of a circular reference, which ultimately can be resolved. Here, you have an income statement that includes bonuses equal to 20 percent of the net earnings entered as an expense in cell B15 with the formula

```
=B21 * 20%
```



	A	B
1	**Income Statement for 2022- Year Ending December 31**	
2		
3	***Revenues***	150,250
4		
5	***Costs and expenses***	
6	Product costs	(12,175)
7	Marketing and sales	(20,785)
8	General and administrative	(17,850)
9	Total costs and expenses	**(50,810)**
10	*Operating income (loss)*	99,440
11		
12	***Other income (expenses)***	
13	Interest income	2,500
14	Interest expense	(500)
15	Bonuses	=B21 * 20%
16	Other	600
17	*Total other income (expenses)*	2,600
18		
19	***Income (loss) before taxes***	102,040
20	Provision (benefit) for taxes	(15,306)
21	*Net earnings (loss)*	86,734
22		

Microsoft Excel

There are one or more circular references where a formula refers to its own cell either directly or indirectly. This might cause them to calculate incorrectly.

Try removing or changing these references, or moving the formulas to different cells.

FIGURE 1-22: Income statement with a resolvable circular reference.

This formula contains a circular reference because it refers to the value in B21, which itself indirectly depends on the amount of bonuses (the bonuses being accounted for as an expense in the very worksheet formulas that determine the amount of net earnings in cell B21).

To resolve the circular reference in cell B15 and calculate the bonuses based on net earnings in B21, you need to click the Enable Iterative Calculation check box in the Calculation Options section of the Formulas tab in the Excel Options dialog box (File ⇒ Options ⇒ Formulas or Alt + FTF). However, if manual recalculation is selected, you must click the Formulas tab's Calculate Now command (or press F9 or Ctrl + =) as well.

Chapter 2

Logical Functions and Error Trapping

IN THIS CHAPTER

- **Understanding formula error values**
- **Understanding the logical functions**
- **Creating IF formulas that trap errors**
- **Auditing formulas**
- **Changing the Error Checking options**
- **Masking error values in your printouts**

Excel formulas can become quite complex and one of the iron-clad rules of spreadsheet work is that as complexity increases, so does the chance of having errors infest your work. If you're starting to see errors in your worksheets, you've come to the right place: Troubleshooting the formula errors in a worksheet is the main topic of this chapter. Here, you see how to locate the source of all those vexing formula errors so that you can shoot them down and set things right! The biggest problem with errors in your formulas — besides how ugly such values as #REF! and #DIV/0! are — is that they spread like wildfire through the workbook to other cells containing formulas that refer to the error-laden cells. If you're dealing with a large worksheet in a workbook with lots of tabs, you may have a hard time figuring out which cell contains the formula that's causing all the mayhem. And if you can't track down the cell that's the cause of all this unpleasantness, you really have no way of restoring law and order to your workbook. Fortunately, as you discover in this chapter, Excel offers a few powerful formula auditing tools that help you locate and examine pesky worksheet errors.

Keeping in mind that the best defense is a good offense, you also find out in this chapter how to isolate potential errors at their source and thereby prevent them from wreaking havoc on the rest of your worksheet. This technique, known affectionately as *error trapping*, is accomplished by skillfully using the IF function to look for potential errors and to provide formula alternatives to work around any error that rears its head.

Understanding Error Values

If Excel can't properly calculate a formula that you enter in a cell, the program displays an *error value* in the cell as soon as you complete the formula entry. Excel uses several error values, all of which begin with the number sign (#), which is not to be confused with the ######## that Excel displays in a cell when its entry is too long to fit. Table 2-1 shows you the error values in Excel along with the meanings and the most probable causes for their display. To remove an error value from a cell, you must discover what caused the value to appear and then edit the formula so that Excel can complete the desired calculation.

If a formula in your worksheet contains a reference to a cell that returns an error value, that formula returns that error value as well. This can cause error values to appear throughout the worksheet, and make it look like it's riddled with errors. But the good news is that (hopefully!) just a single error is getting propagated around the worksheet. The bad news is that all those error values can make it very difficult for you to discover which cell contains the formula that caused the original error value so that you can fix the problem. Not to worry, though: You find out about Excel's tools for finding errors a bit later (see "Checking It Twice: Auditing Your Formulas").

TABLE 2-1 Error Values in Excel

Error Value	***Meaning***	***Causes***
#CALC!	Unsupported formula or expression	Excel encountered a formula or expression that it doesn't support, such as an array nested inside an array.
#DIV/0!	Division by zero	The division operation in your formula refers to an operand (such as a cell or function result) that contains the value 0 or is blank.
#FIELD!	Invalid linked data type	Your formula refers to a linked data type that doesn't exist or is in some other way invalid.
#N/A	No value available	Your formula was unable to return a valid result. For example, many worksheet functions return #N/A if you omit a required argument or use an invalid argument.
#NAME?	Excel doesn't recognize a name	This error value appears when you incorrectly type the range name, refer to a deleted range name, or forget to put quotation marks around a text string in a formula (causing Excel to think that you're referring to a range name).
#NULL!	You specified an intersection of two ranges that don't intersect	Because the space is the intersection operator, this error occurs if you insert a space instead of a comma (the union operator) between ranges used in function arguments.

#NUM!	Problem with a number in the formula	This error can be caused by an invalid argument in an Excel function or a formula that produces a number too large or too small to be represented in the worksheet.
#REF!	Invalid cell reference	This error occurs when you delete a cell referred to in the formula or if you paste cells over the ones referred to in the formula.
#SPILL!	Non-empty spill range	Your dynamic array formula (see Book 3, Chapter 1) can't spill the array results because the spill range contains one or more cells that aren't empty.
#UNKNOWN!	Unsupported data type	Your formula uses a data type that isn't supported by your Excel version.
#VALUE!	Wrong type of argument in a function or wrong type of operator	Most often the result of specifying a mathematical operation with one or more cells that contain text.

Using Logical Functions

In Excel, a logical expression is one that returns either of the following values:

- **TRUE:** This logical value means that the expression is valid. For example, the expressions 2=2 and 5<10 would resolve to TRUE.
- **FALSE:** This logical value means that the expression is not valid. For example, the expressions 2< >2 and 5>10 would resolve to FALSE.

A logical function, therefore, is a function that evaluates to either TRUE or FALSE. You can find Excel's logical functions either in the Logical category of the Insert Function dialog box or on the Ribbon's Formulas tab in the Logical command's drop-down menu (Alt+ML). Here are the names of the functions along with their argument syntax:

- AND(*logical1*, *logical2*,…) — Tests whether the *logical* arguments are all TRUE. If the arguments are all TRUE, the AND function returns TRUE; if one or more of the arguments are FALSE, the AND function returns FALSE.
- FALSE( ) — Returns FALSE.
- IF(*logical_test*, *value_if_true*, *value_if_false*) — Tests whether the *logical_test* expression is TRUE or FALSE. If the expression is TRUE, the IF function returns the *value_if_true* argument; if the expression is FALSE, the IF function returns the *value_if_false* argument.
- IFERROR(*value*, *value_if_error*) — Tests whether the *value* expression returns an error. If *value* is not an error, IFERROR returns the *value* argument; otherwise, IFERROR returns the *value_if_error* argument.
- IFNA(*value*, *value_if_na*) — Tests whether the *value* expression returns the #N/A error. If *value* is not #N/A, IFNA returns the *value* argument; otherwise, IFNA returns the *value_if_na* argument.

- =IFS(*logical_test1*, *value_if_true1, logical_test2*, *value_if_true2, …*) — Tests whether the *logical_test* arguments return TRUE or FALSE. If one or more of the *logical_test* arguments return TRUE, IFS returns the corresponding value argument (*value_if_true1* for *logical_test1*, *value_if_true2* for *logical_test*2 and so on) for the first test that returns TRUE. If none of the *logical_test* arguments return TRUE, IFS returns the #N/A error value.

- NOT(*logical*) — Tests whether the *logical* argument is TRUE or FALSE and returns the opposite logical value. That is, if *logical* is TRUE, NOT returns FALSE; if *logical* is FALSE, NOT returns TRUE.

- OR(*logical1*, *logical2*,*…*) — Tests whether at least one of the *logical* arguments is TRUE. If one or more arguments return TRUE, OR returns TRUE; if all the arguments return FALSE, OR returns FALSE.

- SWITCH(*expression*, *value1, result1, [default]*) — Tests the value returned by the *expression* argument against a list of value arguments (*value1*, *value2*, and so on to *value126*) and returns the corresponding result (*result1* for *value1*, *result*2 for *value2*, and so on to *result126* for *value126*) when a match is TRUE. The optional *default* argument is returned when none of the value arguments match the expression argument. When no *default* argument is specified, Excel returns the #N/A error value when there is no match.

- TRUE( ) — Returns TRUE.

- XOR(*logical1*, *logical2*,*…*) — Tests whether the *logical* arguments (usually in an array) are TRUE or FALSE. When there are just two arguments, XOR returns TRUE if one and only one argument is TRUE; if neither argument is TRUE or if both arguments are TRUE, XOR returns FALSE. (These results are why XOR is called the *exclusive OR* function.) Things get weird with three or more arguments. In that case, XOR returns TRUE when the number of TRUE arguments is odd and XOR returns FALSE when the number of TRUE arguments is even.

The *logical_test* and *logical* arguments that you specify for these logical functions usually employ the comparison operators (=, <, >, <=, >=, or <>), which themselves return logical TRUE or logical FALSE values. For example, suppose that you enter the following formula in your worksheet:

```
=AND(B5=D10, C15>=500)
```

In this formula, Excel first evaluates the first logical argument to determine whether the contents in cell B5 and D10 are equal. If they are, the first comparison returns TRUE. If they're not equal, this comparison returns FALSE. The program then evaluates the second logical argument to determine whether the content of cell C15 is greater than or equal to 500. If it is, the second comparison returns TRUE. If it isn't greater than or equal to 500, this comparison returns FALSE.

After evaluating the comparisons in the two *logical* arguments, the AND function compares the results: If *logical* argument 1 and *logical* argument 2 are both found to be TRUE, the AND function returns logical TRUE. If, however, either argument is (or both arguments are) found to be FALSE, the AND function returns logical FALSE.

Getting to know the powerful IF function

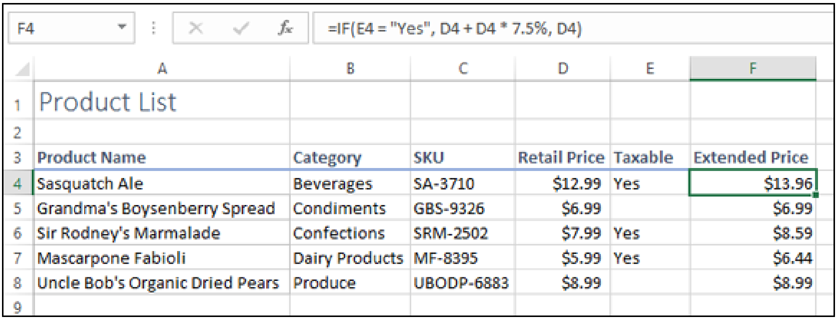
When you use the IF function, you specify what's called a *logical_test* argument whose outcome determines whether the *value_if_true* or *value_if_false* argument is evaluated and returned. The *logical_test* argument normally uses comparison operators, which return either the logical TRUE or logical FALSE value. When the argument returns TRUE, the entry or expression in the *value_if_true* argument is returned. When the argument returns FALSE, the entry or expression in the *value_if_false* argument is returned.

Figure 2-1 (sample workbook: Products to Buy.xlsx) shows a list of products to be purchased. Consider the following formula that uses the IF function to determine whether to charge tax on an item:

```
=IF(E4="Yes", D4 + D4 * 7.5%, D4)
```

If cell E4 (the first cell in the column where you indicate whether the item being sold is taxable or not) contains "Yes," the IF function uses the *value_if_true* argument that tells Excel to add the extended price entered in cell D4, multiply it by a tax rate of 7.5%, and then add the computed tax to the extended price. If, however, cell D4 is blank or contains anything other than the text "Yes," the IF function uses the *value_if_false* argument, which tells Excel to just return the extended price to cell D4 without adding any tax to it.

As you can see, the *value_if_true* and *value_if_false* arguments of the IF function can contain constants or expressions whose results are returned to the cell that holds the IF formula.



F4

=IF(E4 = "Yes", D4 + D4 * 7.5%, D4)

	A	B	C	D	E	F
1	Product List					
2						
3	Product Name	Category	SKU	Retail Price	Taxable	Extended Price
4	Sasquatch Ale	Beverages	SA-3710	$12.99	Yes	$13.96
5	Grandma's Boysenberry Spread	Condiments	GBS-9326	$6.99		$6.99
6	Sir Rodney's Marmalade	Confections	SRM-2502	$7.99	Yes	$8.59
7	Mascarpone Fabioli	Dairy Products	MF-8395	$5.99	Yes	$6.44
8	Uncle Bob's Organic Dried Pears	Produce	UBODP-6883	$8.99		$8.99
9						

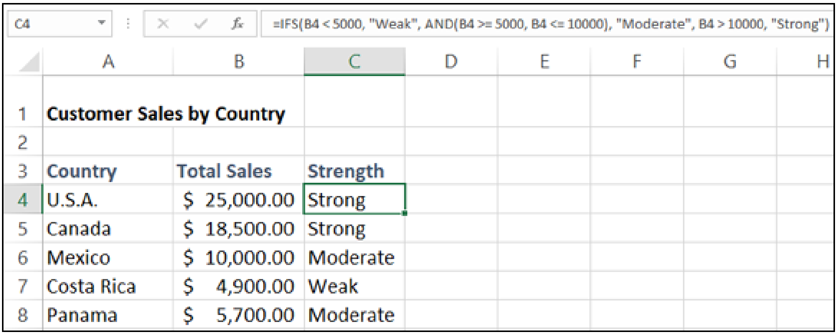
FIGURE 2-1: Using the IF function to determine whether to charge tax on an item. (Sample workbook: Products to Buy.xlsx)

Evaluating the many talents of the IFS function

The IFS logical function enables you to test for multiple conditions (up to a maximum of 127) all in a single formula without having to go through the trouble and potential confusion of nesting multiple IF functions.

The worksheet shown in Figure 2-2 (sample workbook: Customer Sales by Country.xlsx) illustrates how this nifty and powerful function works. Here, I want to test for three conditions:

- "Weak" customer sales, meaning the amount is less than $5,000
- "Moderate" customer sales, meaning the amount is between $5,000 and $10,000
- "Strong" customer sales, meaning the amount is above $10,000



C4

=IFS(B4 < 5000, "Weak", AND(B4 >= 5000, B4 <= 10000), "Moderate", B4 > 10000, "Strong")

	A	B	C	D	E	F	G	H
1	Customer Sales by Country							
2								
3	Country	Total Sales	Strength					
4	U.S.A.	$ 25,000.00	Strong					
5	Canada	$ 18,500.00	Strong					
6	Mexico	$ 10,000.00	Moderate					
7	Costa Rica	$ 4,900.00	Weak					
8	Panama	$ 5,700.00	Moderate					

FIGURE 2-2: Using the IFS function to test multiple conditions in a single formula. (Sample workbook: Customer Sales by Country.xlsx)

To do this with the IFS function, I created the following formula in cell C4 of my worksheet that evaluates the sales amount in cell B4:

```
=IFS(B4 < 5000, "Weak", AND(B4 >= 5000, B4 <= 10000),
"Moderate", B4 > 10000, "Strong")
```

This IFS function contains three different *logical_test* arguments, using three different *value_if_true* resulting arguments:

- If the value in cell B4 is less than 5000, then return the text entry *Weak* as the value in cell C4
- If the value in cell B4 is both greater than or equal to 5,000 and less than or equal to 10,000 (tested using the nested AND function), then return the text entry *Moderate* as the value in cell C4
- If the value in cell B4 is greater than 10,000, then return the text entry *Strong* as the value in cell C4

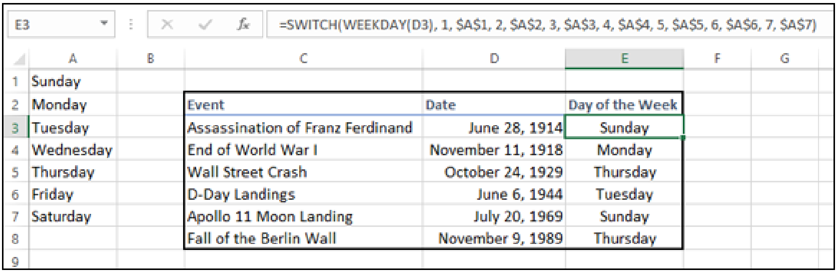
Figure 2-2 shows the result of copying the original IFS function formula in cell C4 down the range C5:C8 of the worksheet so that all the values entered in column B are evaluated as weak, moderate, or strong.

Learning about the SWITCH function

The SWITCH logical function enables you to test a value returned by a single *expression* argument against a series of *value* arguments (up to 126), each of which is followed in the syntax by a *result* argument. When SWITCH comes across the first *value* argument that matches the *expression*, it returns the corresponding *result* argument.

To see how this works, consider the example shown in Figure 2-3 (sample workbook: Famous Events.xlsx). Here, I've entered the names of the days of the week in cell range A1:A7. In the cell range D3:D8, I've entered the dates of the famous events listed in C3:C8. The question I want to answer here is, for each date, on which day of the week did the event occur? To find out, in E3 I entered the first formula, which uses the SWITCH logical function with a nested WEEKDAY function followed by a series of *value* and *result* arguments as follows:

```
=SWITCH(WEEKDAY(D3), 1, $A$1, 2, $A$2, 3, $A$3, 4, $A$4, 5, $A
$5, 6, $A$6, 7, $A$7)
```



E3

=SWITCH(WEEKDAY(D3), 1, $A$1, 2, $A$2, 3, $A$3, 4, $A$4, 5, $A$5, 6, $A$6, 7, $A$7)

	A	B	C	D	E	F	G
1	Sunday						
2	Monday		Event	Date	Day of the Week		
3	Tuesday		Assassination of Franz Ferdinand	June 28, 1914	Sunday		
4	Wednesday		End of World War I	November 11, 1918	Monday		
5	Thursday		Wall Street Crash	October 24, 1929	Thursday		
6	Friday		D-Day Landings	June 6, 1944	Tuesday		
7	Saturday		Apollo 11 Moon Landing	July 20, 1969	Sunday		
8			Fall of the Berlin Wall	November 9, 1989	Thursday		
9							

FIGURE 2-3: Using the SWITCH function to match days of the week against a series of results returned by a WEEKDAY function. (Sample workbook: Famous Events.xlsx)

The WEEKDAY function in this formula returns the day of week in any date as a number between 1 for Sunday and 7 for Saturday (see Book 3, Chapter 3 for more on using Date functions). This WEEKDAY function with cell D3 as its serial date number argument serves as the *expression* argument of the SWITCH function. Following this *expression* argument, you see a series of *value* and *result* arguments. When the WEEKDAY function returns one of the values (between 1 and 7), the SWITCH argument replaces it with the corresponding days of the week in the cell range A1:A7 as a vertical lookup table.

Note that when I entered the individual cell references from this lookup table into the appropriate *result* argument in the formula, I switched the cell reference from its default relative cell reference (as in A1, A2, and so forth) to its absolute cell reference ($A$1, $A$2, and so on). However, when I entered the cell reference D3 as the *serial_number* argument of the WEEKDAY function, I left it a relative reference. I did this so I could successfully copy the original formula created in cell E3 down to the range E4:E8 by having Excel adjust the D3 reference in the original formula in each copy to its appropriate row in column D, while at the same time preventing Excel from returning results for matches from any other cells outside the A1:A7 lookup table.

Figure 2-3 shows the results. The original formula with the SWITCH function in cell E3 has been copied down the column to the cell range E4:E8. These formulas all compare the day of the week number calculated by the WEEKDAY function on the dates in corresponding cells in the same row of column D. They then return the matching name of the day of the week from the cell range A1:A7 to their respective cells.

Error-Trapping Formulas

Sometimes, you know ahead of time that certain error values are unavoidable in a worksheet if it's missing certain data. The most common error value that gets you into this kind of trouble is our old friend, the #DIV/0! error value. Suppose, for example, that you're creating a new sales workbook from your sales template, and one of the rows in this template contains formulas that calculate the percentage that each monthly total is of the quarterly total. To work correctly, the formulas must divide the value in the cell that contains the monthly total by the value in the cell that contains the quarterly total. When you start a new sales workbook from its template, the cells that contain the formulas for determining the quarterly totals contain zeros, and these zeros put #DIV/0! errors in the cells with formulas that calculate the monthly/quarterly percentages.

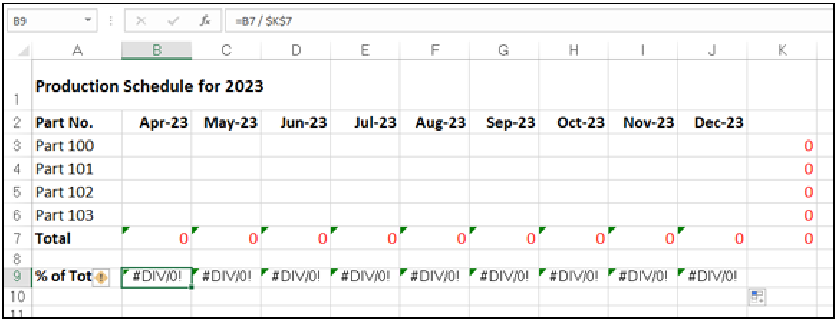
These particular #DIV/0! error values in the new workbook don't really represent mistakes as such because they automatically disappear as soon as you enter some of the monthly sales for each quarter (so that the calculated quarterly totals are no longer 0). The problem that you may have is convincing your nonspreadsheet-savvy coworkers (especially the boss) that, despite the presence of all these error values in your worksheet, the formulas are hunky-dory. All that your coworkers see is a worksheet riddled with error values, and these error values undermine your coworkers' confidence in the correctness of your worksheet.

REMEMBER Well, I have the answer for just such "perception" problems. Rather than risk having your manager upset over the display of a few little #DIV/0! errors here and there, you can set up these formulas so that, whenever they're tempted to return any type of error value (including #DIV/0!), they instead return a non-error value, such as some text (for example, "Waiting for the quarterly total") or a zero.

Error-trapping with IF

This sleight of hand in an original formula not only effectively eliminates errors from the formula but also prevents their spread to any cells that are dependent on the formula. To create such a formula, you use the IF function, which operates one way when a certain condition exists and another when it doesn't.

To see how you can use the IF function in a formula that sometimes gives you a #DIV/0! error, consider the sample worksheet shown in Figure 2-4 (sample workbook: Production Schedule 2023.xlsx). This figure shows a blank Production Schedule worksheet for storing the 2023 production figures arranged by month and part number. Because I haven't yet had a chance to input any data into this table, the SUM formulas in the last row and column contain 0 values. Because cell K7 with the grand total currently also contains 0, all the percent-of-total formulas in the cell range B9:J9 contain #DIV/0! error values.



B9 =B7 / $K$7

	A	B	C	D	E	F	G	H	I	J	K
1	**Production Schedule for 2023**										
2	**Part No.**	**Apr-23**	**May-23**	**Jun-23**	**Jul-23**	**Aug-23**	**Sep-23**	**Oct-23**	**Nov-23**	**Dec-23**	
3	Part 100										0
4	Part 101										0
5	Part 102										0
6	Part 103										0
7	**Total**	0	0	0	0	0	0	0	0	0	0
8											
9	**% of Tot**	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	
10											

FIGURE 2-4: Blank 2023 Production Schedule spreadsheet that's full of #DIV/0! errors. (Sample workbook: Production Schedule 2023.xlsx)

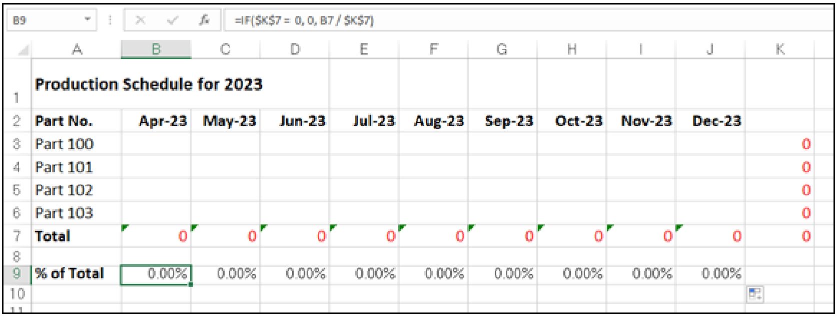
The first percent-of-total formula in cell B9 contains the following:

```
=B7 / $K$7
```

Because cell K7 with the grand total contains 0, the formula returns the #DIV/0! error value. Now, let me show you how to set a trap for the error in the *logical_test* argument inside an IF function. After the *logical_test* argument, you enter the *value_if_true* argument (which is 0 in this example) and the *value_if_false* argument (which is the B7/$K$7). With the addition of the IF function, the final formula looks like this:

```
=IF($K$7 = 0, 0, B7 / $K$7)
```

This formula then inputs 0 into cell B9, as shown in Figure 2-5, when the formula actually returns the #DIV/0! error value (because cell K7 is still empty or has a 0 in it), and the formula returns the percentage of total production when the formula doesn't return the #DIV/0! error value (because cell K7 with the total production divisor is no longer empty or contains any other value besides 0). Next, all you have to do is copy this error-trapping formula in cell B9 over to J9 to remove all the #DIV/0! errors from this worksheet.



B9 =IF($K$7 = 0, 0, B7 / $K$7)

	A	B	C	D	E	F	G	H	I	J	K
1	**Production Schedule for 2023**										
2	**Part No.**	**Apr-23**	**May-23**	**Jun-23**	**Jul-23**	**Aug-23**	**Sep-23**	**Oct-23**	**Nov-23**	**Dec-23**	
3	Part 100										0
4	Part 101										0
5	Part 102										0
6	Part 103										0
7	**Total**	0	0	0	0	0	0	0	0	0	0
8											
9	**% of Total**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
10											

FIGURE 2-5: 2023 Production Schedule spreadsheet after trapping all the #DIV/0! errors.

Upping your error-trapping game with ISERROR

The error-trapping formula created with the IF function in cell B9 works fine as long as you know that the grand total in cell K7 will contain either 0 or some other numerical value. It does not, however, trap any of the various error values, such as #REF! and #NAME?, nor does it account for the special #N/A (Not Available) value. If, for some reason, one of the formulas feeding into the SUM formula in K7 returns one of these beauties, they suddenly cascade throughout all the cells with the percent-of-total formulas (cell range B9:J9).

To trap all error values in the grand total cell K7 and prevent them from spreading to the percent-to-total formulas, you need to add the ISERROR function to the basic IF formula. The ISERROR function returns the logical value TRUE if the cell specified as its argument contains any type of error value, including the special #N/A value (if you use ISERR instead of ISERROR, it checks for all types of error values except for #N/A).

To add the ISERROR function, place it in the IF function as the *logical_test* argument. If, indeed, K7 does contain an error value or the #N/A value at the time the IF function is evaluated, you specify 0 as the *value_if_true* argument so that Excel inputs 0 in cell B9 rather than an error value or #N/A. For the *value_if_false* argument, you specify the original IF function that inputs 0 if the cell K7 contains 0; otherwise, it performs the division that computes what percentage the April production figure is of the total production.

This amended formula with the ISERROR and two IF functions in cell B9 looks like this:

```
=IF(ISERROR($K$7), 0, IF($K$7 = 0, 0, B7 / $K$7))
```

As soon as you copy this original formula to the cell range C9:J9, you've protected all the cells with the percent-of-total formulas from displaying and spreading any of those ugly error values.

TIP Some people prefer to remove the display of zero values from any template that contains error-trapping formulas so that no one interprets the zeros as the correct value for the formula. To remove the display of zeros from a worksheet, deselect the Show a Zero in Cells That Have Zero Value check box in the Display Options for this Worksheet section of the Advanced tab of the Excel Options dialog box (File⇒ Options or Alt+FT). By this action, the cells with error-trapping formulas remain blank until you give them the data that they need to return the correct answers!

Whiting-Out Errors with Conditional Formatting

Instead of creating logical formulas to suppress the display of potential error values, you can use Conditional Formatting (see Book 2, Chapter 2 for details) to deal with them. All you have to do is create a new conditional formatting rule that displays all potential error values in a white font (essentially, rendering them invisible in the cells of your worksheet). I think of using conditional formatting in this manner to deal with possible error values in a worksheet as applying a kind of electronic white-out that masks rather than suppresses formula errors.

To create this conditional formatting white-out for cells containing formulas that could easily be populated with error values, follow these steps:

1. **Select the ranges of cells with the formulas to which you want the new conditional formatting rule applied.**
2. **Click the Conditional Formatting button on the Home tab and then click New Rule from its drop-down menu (Alt+HLN).**

   Excel displays the New Formatting Rule dialog box.

3. **Click the Format Only Cells That Contain option in the Select a Rule Type section at the top of the New Formatting Rule dialog box.**
4. **Click the Errors item from the Cell Value drop-down menu under Format Only Cells With section of the New Formatting Rule dialog box.**

   The New Formatting Rule dialog box now contains an Edit the Rule Description section at the bottom of the dialog box with Errors displayed under the Format Only Cells With heading.
5. **Click the Format button to the immediate right of the Preview text box that now contains No Format Set.**

   Excel opens the Format Cells dialog box with the Font tab selected.
6. **Click the Color drop-down menu button, click the white swatch (the very first one on the color palette displayed under Theme Colors), and then click OK.**

   Excel closes the Format Cells dialog box and the Preview text box in the New Formatting Rule dialog box now appears empty (as the No Format Set text is now displayed in a white font).
7. **Click OK in the New Formatting Rule dialog box to close it and apply the new conditional formatting rule to your current cell selection.**

TIP After applying the new conditional formatting rule to a cell range, you can test it out by deliberately entering an error value into one of the cells referenced in one of the formulas in that range now covered by the “white-out” conditional formatting. Entering the #N/A error value in one of these cells with the =NA( ) function is perhaps the easiest to do.

Instead of seeing #N/A values spread throughout the cell range, the cells should now appear empty because of the white font applied to all the #N/As, rendering them, for all intents and purposes, invisible.

Checking It Twice: Auditing Your Formulas

Auditing your worksheet's formulas means taking a close look at your formulas and their results to make sure everything is error-free and accurate. Auditing is generally a three-step process:

1. Examine your worksheet for formula errors (such as #DIV/0! and #NAME?).
2. If an error is getting propagated through multiple cells, locate the original cell that's causing the error.
3. Fix the error.

Fortunately, Excel offers some very effective formula auditing tools for tracking down the cell that’s causing your error woes by tracing the relationships between the formulas in the cells of your worksheet. By tracing the relationships, you can test formulas to see which cells, called *direct precedents* in spreadsheet jargon, directly feed the formulas and which cells, called *dependents* (nondeductible, of course), depend on the results of the formulas. Excel even offers a way to visually backtrack the potential sources of an error value in the formula of a particular cell.

You can see the formula auditing tools on the Ribbon's Formulas tab, in the Formula Auditing group. This groups contains the following commands:

- **Trace Precedents:** Draws arrows to the cells (the so-called *direct precedents*) that are referred to in the formula inside the selected cell. When you click this button again, Excel adds “tracer” arrows that show the cells (the so-called indirect precedents) that are referred to in the formulas in the direct precedents.
- **Trace Dependents:** Draws arrows from the selected cell to the cells (the so-called *direct dependents*) that use, or depend on, the results of the formula in the selected cell. When you click this button again, Excel adds tracer arrows identifying the cells (the so-

called *indirect dependents*) that refer to formulas found in the direct dependents.

- **Remove Arrows:** Removes all the arrows drawn, no matter what button or pull-down command you used to put them there. Click the drop-down button attached to this button to display a drop-down menu with three options:
    - *Remove Arrows:* Removes all arrows (just like clicking the Remove Arrows command button).
    - *Remove Precedent Arrows:* Gets rid of the arrows that were drawn when you clicked the Trace Precedents button.
    - *Remove Dependent Arrows:* Gets rid of the arrows that were drawn when you clicked the Trace Dependents button.
- **Show Formulas:** Displays all formulas in their cells in the worksheet instead of their calculated values — just like pressing Ctrl+` (back tick).
- **Error Checking:** Displays the Error Checking dialog box, which describes the nature of the error in the current cell, gives you help on it, and enables you to trace its precedents. Click the Trace Error option from this button's drop-down menu to attempt to locate the cell that contains the original formula that has an error. Click the Circular References option from this button's drop-down menu to display a continuation menu with a list of all the cell addresses containing circular references in the active worksheet — click a cell address on this menu to select the cell with a circular reference formula in the worksheet. (See Book 3, Chapter 1 for more on circular references in formulas.)
- **Evaluate Formula:** Opens the Evaluate Formula dialog box, where you can have Excel evaluate each part of the formula in the current cell. The Evaluate Formula feature can be quite useful in formulas that nest many functions within them.
- **Watch Window:** Opens the Watch Window dialog box, which displays the workbook, sheet, cell location, range name, current value, and formula in any cells that you add to the watch list. That way, you can keep an eye on a cell's current value even when you're working in another worksheet or workbook. To add a cell to the watch list, click the cell in the worksheet, click the Add Watch button in the Watch Window dialog box, and then click Add in the Add Watch dialog box that appears.

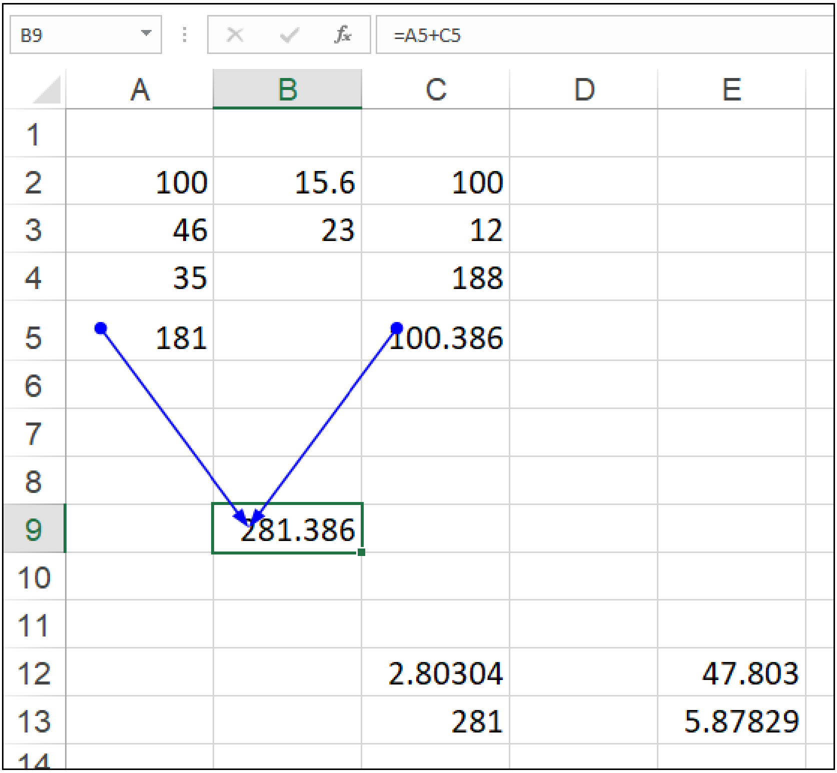
Clicking the Trace Precedents and Trace Dependents buttons in the Formula Auditing group of the Formulas tab on the Ribbon lets you see the relationship between a formula and the cells that directly and indirectly feed it, as well as those cells that directly and indirectly depend on its calculation. Excel establishes this relationship by drawing arrows from the precedent cells to the active cell and from the active cell to its dependent cells.

If these cells are on the same worksheet, Excel draws solid red or blue arrows extending from each of the precedent cells to the active cell and from the active cell to the dependent cells. If the cells are not located locally on the same worksheet (they may be on another sheet in the same workbook or even on a sheet in a different workbook), Excel draws a black dotted arrow. This arrow comes from or goes to an icon picturing a miniature worksheet that sits to one side, with the direction of the arrowheads indicating whether the cells on the other sheet feed the active formula or are fed by it.

Tracing precedents

On the Ribbon's Formulas tab, you can click the Trace Precedents command button (or press Alt+MP) to trace all the generations of cells that contribute to the formula in the selected cell (kind of like tracing all the ancestors in your family tree). Figures 2-6 and 2-7 (sample workbook: Error Tracing.xlsx, for both) illustrate how you can use the Trace Precedents command button or its hot key equivalent to quickly locate the cells that contribute, directly and indirectly, to the simple addition formula in cell B9.

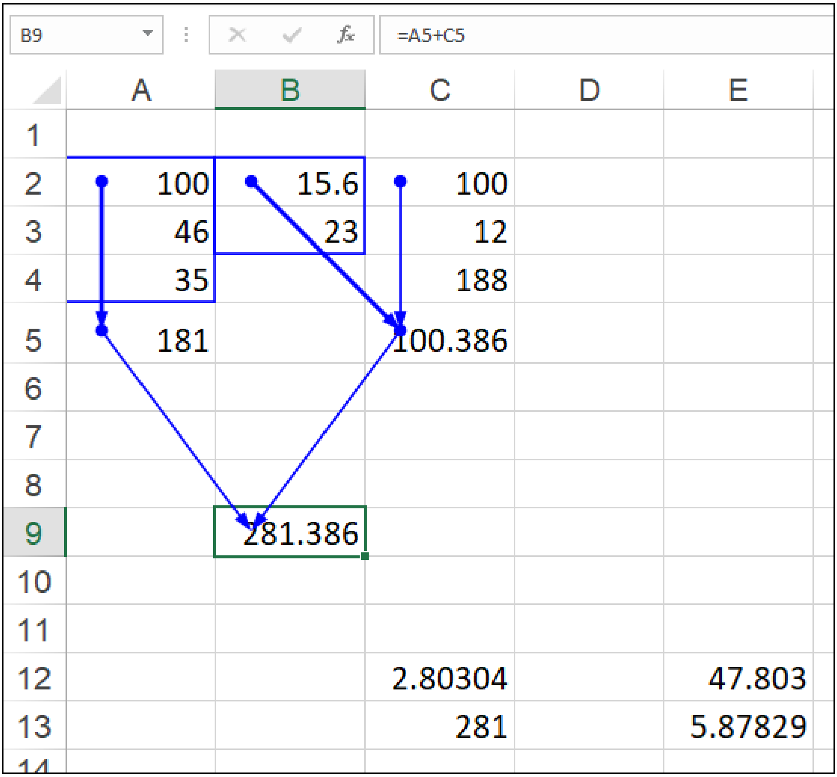
Figure 2-6 shows the worksheet after I clicked the Trace Precedents command button the first time. As you can see, Excel draws trace arrows from cells A5 and C5 to indicate that they are the direct precedents of the addition formula in cell B9.



=A5+C5

	A	B	C	D	E
1					
2	100	15.6	100		
3	46	23	12		
4	35		188		
5	181		100.386		
6					
7					
8					
9		281.386			
10					
11					
12			2.80304		47.803
13			281		5.87829
14					

FIGURE 2-6: Clicking the Trace Precedents command button shows the direct precedents of the formula. (Sample workbook: Error Tracing.xlsx)



B9

=A5+C5

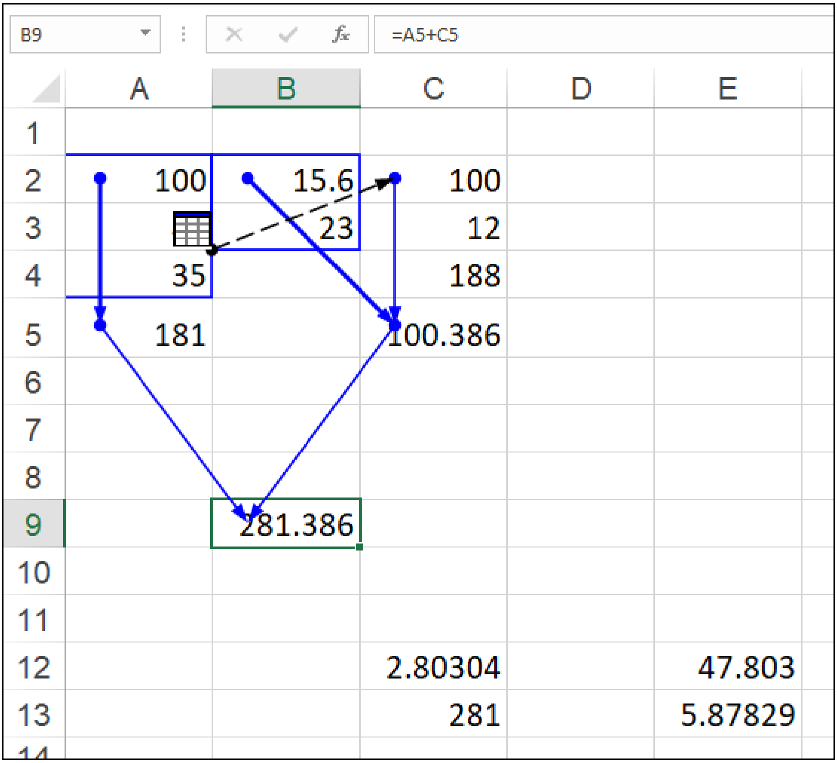
	A	B	C	D	E
1					
2	100	15.6	100		
3	46	23	12		
4	35		188		
5	181		100.386		
6					
7					
8					
9		281.386			
10					
11					
12			2.80304		47.803
13			281		5.87829

FIGURE 2-7: Clicking the Trace Precedents command button again shows the indirect precedents of the formula. (Sample workbook: Error Tracing.xlsx)

In Figure 2-7, you see what happened when I clicked this command button a second time to display the indirect precedents of this formula. (Think of them as being a generation earlier in the family tree.) The new tracer arrows show that cells A2, A3, and A4 are the direct precedents of the formula in cell A5 — indicated by a border around the three cells. (Remember that cell A5 is the first direct precedent of the formula in cell B9.) Likewise, cells B2 and B3 as well as cell C2 are the direct precedents of the formula in cell C5. (Cell C5 is the second direct precedent of the formula in cell B9.)

Each time you click the Trace Precedents command button, Excel displays another (earlier) set of precedents, until no more generations exist. If you are in a hurry (as most of us are most of the time), you can speed up the process and display both the direct and indirect precedents in one operation by double-clicking the Trace Precedents command button. To clear the worksheet of tracer arrows, click the Remove Arrows command button on the Formulas tab.

Figure 2-8 (sample workbook: Error Tracing.xlsx) shows what happened after I clicked the Trace Precedents command button a third time (after clicking it twice before, as shown in Figures 2-6 and 2-7). Clicking the command button reveals both the indirect precedents for cell C5. The formulas in cells B2 and C2 are the direct precedents of the formula in cell C5. The direct precedent of the formula in cell C2 (and, consequently, the indirect precedent of the one in cell C5) is not located on this worksheet. This fact is indicated by the dotted tracer arrow coming from that cute miniature worksheet icon sitting on top of cell A3.



B9

=A5+C5

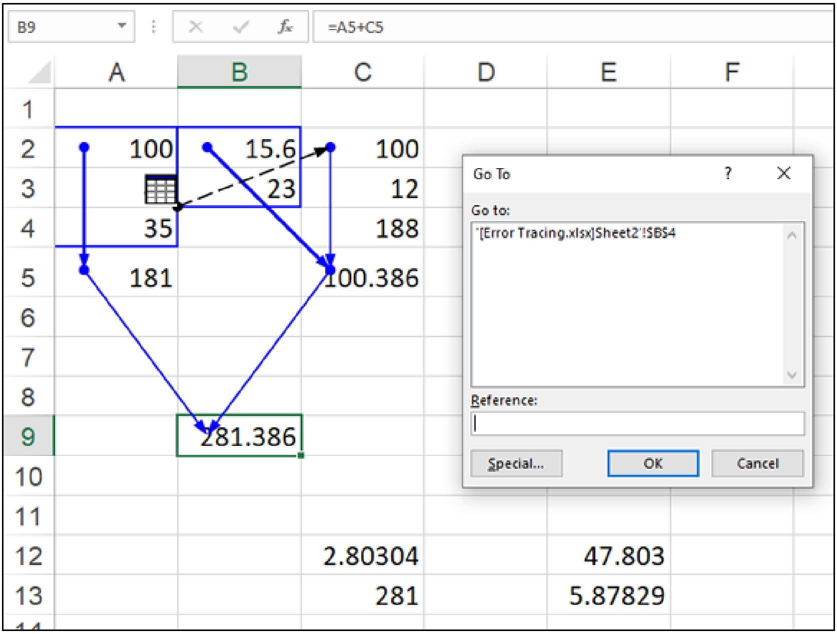
	A	B	C	D	E
1					
2	100	15.6	100		
3		23	12		
4	35		188		
5	181		100.386		
6					
7					
8					
9		281.386			
10					
11					
12			2.80304		47.803
13			281		5.87829

FIGURE 2-8: Clicking the Trace Precedents command button a third time shows a precedent on another worksheet. (Sample workbook: Error Tracing.xlsx)

To find out exactly which workbook, worksheet, and cell(s) hold the direct precedents of cell C2, I double-clicked somewhere on the dotted arrow. (Clicking the icon with the worksheet miniature doesn't do a thing.) Double-clicking the dotted tracer arrow opens the Go To dialog box, which shows a list of all the precedents, including the workbook, worksheet, and cell references. To go to a precedent on another worksheet, double-click the reference in the Go To list box, or select it and click OK. (If the worksheet is in another workbook, this workbook file must already be open before you can go to it.)

The Go To dialog box, shown in Figure 2-9 (sample workbook: Error Tracing.xlsx), displays the following direct precedent of cell C2, which is cell B4 on Sheet2 of the same workbook:

```
'[Error Tracing.xlsx]Sheet2'!$B$4
```



=A5+C5

	A	B	C	D	E	F
1						
2	100	15.6	100			
3		23	12			
4	35		188			
5	181		100.386			
6						
7						
8						
9		281.386				
10						
11						
12			2.80304		47.803	
13			281		5.87829	

Go to:
'[Error Tracing.xlsx]Sheet2'!$B$4

Reference:

FIGURE 2-9: Double-clicking the dotted tracer arrow opens the Go To dialog box showing the location. (Sample workbook: Error Tracing.xlsx)

To jump directly to this cell, double-click the cell reference in the Go To dialog box.

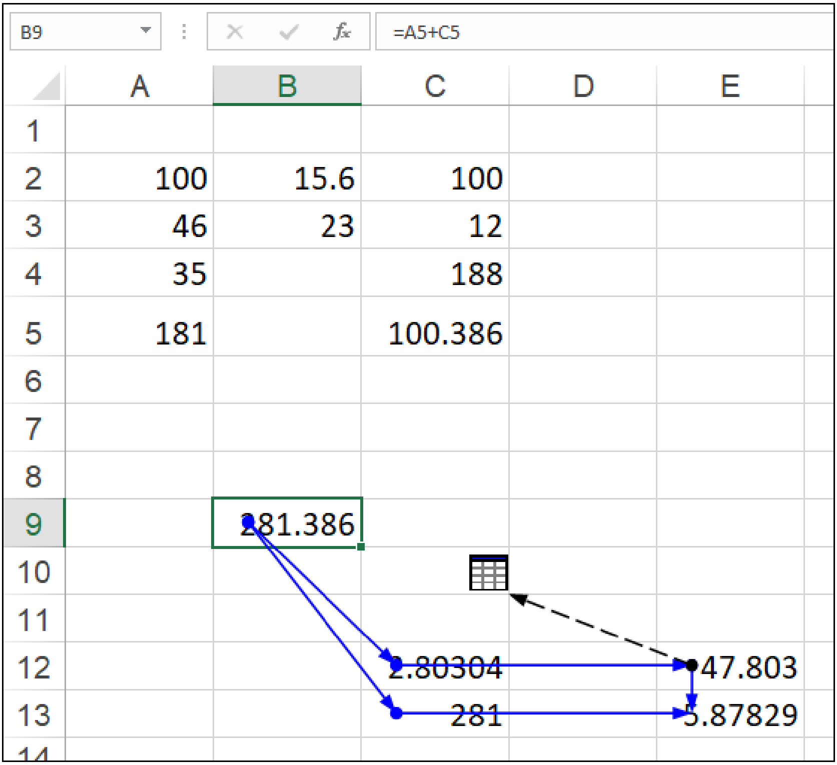
You can also select precedent cells that are on the same worksheet as the active cell by double-clicking somewhere on the cell's tracer arrow. Excel selects the precedent cell without bothering to open up the Go To dialog box.

TIP You can use the Special button in the Go To dialog box (see Figure 2-9) to select all the direct or indirect precedents or the direct or indirect dependents that are on the same sheet as the formula in the selected cell. After opening the Go To dialog box (Ctrl+G or F5) and clicking the Special button, you simply click the Precedents or Dependents option button and then click between the Direct Only and All Levels option buttons before you click OK.

Tracing dependents

On the Ribbon's Formulas tab, you can click the Trace Dependents command button in the Formula Auditing group (or press Alt+MD) to trace all the generations of cells that either directly or indirectly utilize the formula in the selected cell (kind of like tracing the genealogy of all your descendants). Tracing dependents is much like tracing precedents, described in the previous section. Each time you click Trace Dependents, Excel draws another set of arrows that show a generation of dependents further removed. To display both the direct and indirect dependents of a cell in one fell swoop, double-click the Trace Dependents command button.

Figure 2-10 (sample workbook: Error Tracing.xlsx) shows what happened after I selected cell B9 and then double-clicked the Trace Dependents button to display both the direct and indirect dependents and then clicked it a third time to display the dependents on another worksheet.



	A	B	C	D	E
1					
2	100	15.6	100		
3	46	23	12		
4	35		188		
5	181		100.386		
6					
7					
8					
9		281.386			
10					
11					
12			2.80304		47.803
13			281		5.87829

FIGURE 2-10: Clicking the Trace Dependents command button shows all the dependents of the formula in cell B9. (Sample workbook: Error Tracing.xlsx)

As Figure 2-10 shows, Excel first draws tracer arrows from cell B9 to cells C12 and C13, indicating that C12 and C13 are the direct dependents of cell B9. Then, it draws tracer arrows from cells C12 and C13 to E12 and E13, respectively, the direct dependents of C12 and C13 and the indirect dependents of B9. Finally, it draws a tracer arrow from cell E12 to another sheet in the workbook (indicated by the dotted tracer arrow pointing to the worksheet icon).

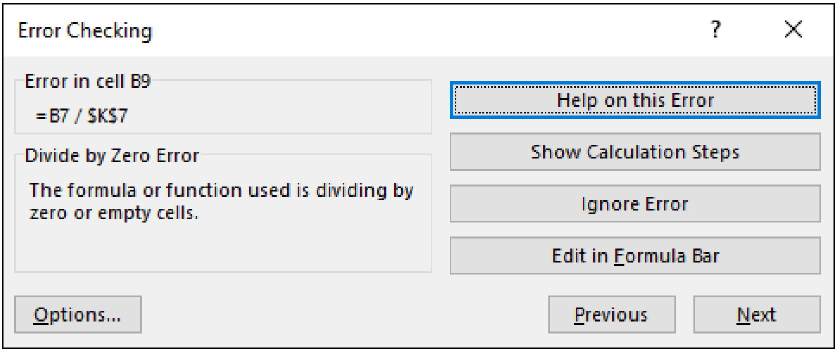
Error checking

Whenever a formula yields an error value other than #N/A (refer to Table 2-1 earlier in this chapter for a list of all the error values) in a cell, Excel displays a tiny error indicator (a green triangle) in the upper-left corner of the cell, and an alert options button appears to the left of that cell when the cell is active. If you position the mouse or Touch pointer on that options button, a drop-down button appears to its right that you can click to display a drop-down menu, and a ScreenTip appears below describing the nature of the error value.

When you click the drop-down button, a menu appears, containing an item with the name of the error value followed by the following items:

- **Help on This Error:** Opens an Excel Help window with information on the type of error value in the active cell and how to correct it.
- **Show Calculation Steps:** Opens the Evaluate Formula dialog box where you can walk through each step in the calculation to see the result of each computation.
- **Ignore Error:** Bypasses error checking for this cell and removes the error alert and Error options button from it.
- **Edit in Formula Bar:** Activates Edit mode and puts the insertion point at the end of the formula on the Formula bar.
- **Error Checking Options:** Opens the Formulas tab of the Excel Options dialog box where you can modify the options used in checking the worksheet for formula errors. (See "Changing the Error Checking options" section that immediately follows for details.)

If you're dealing with a worksheet that contains many error values, you can display the Ribbon's Formulas tab and then click the Error Checking command button (the one with the check mark on top of a red alert exclamation mark) in the Formula Auditing group. Excel selects the cell with the first error value and opens the Error Checking dialog box (see Figure 2-11) that identifies the nature of the error value in the current cell.



Error in cell B9

=B7 / $K$7

Divide by Zero Error

The formula or function used is dividing by zero or empty cells.

FIGURE 2-11: Flagging an error value in a worksheet in the Error Checking dialog box.

The command buttons in the Error Checking dialog box directly correspond to the menu options that appear when you click the cell's alert options button. (Except that Error Checking Options on this drop-down menu is simply called the Options button in this dialog box.)

In addition, the Error Checking dialog box contains Next and Previous buttons that you can click to have Excel select the cell with the next error value or return to the cell with the previously displayed error value.

REMEMBER Note that when you click the Next or Previous button when Excel has flagged the very first or last error value in the worksheet, the program displays an alert dialog box letting you know that the error check for the worksheet is complete. When you click OK, Excel closes both the alert dialog box and the Error Checking dialog box. Also note that clicking the Ignore Error button is the equivalent of clicking the Next button.

Changing the Error Checking options

When you click Error Checking Options from the alert options drop-down menu attached to a cell with an error value or click the Options button in the Error Checking dialog box, Excel opens the Formulas tab of the Excel Options dialog box. This tab displays the Error Checking and Error Checking Rules options that are currently in effect in Excel. You can use these options on this Formulas tab to control when the worksheet is checked for errors and what cells are flagged:

- **Enable Background Error Checking:** When selected, Excel checks your worksheets for errors when the computer is idle.
- **Indicate Errors Using This Color:** Enables you to change the color of the error indicator that appears as a tiny triangle in the upper-left corner of the cell (normally this indicator is green).
- **Reset Ignored Errors:** Restores the error indicator and alert options button to all cells that you previously told Excel to ignore by clicking the Ignore Error item from the alert options drop-down menu attached to the cell.
- **Cells Containing Formulas That Result in an Error:** When selected, Excel inserts the error indicator and adds the alert options button to all cells that return error values.

- **Inconsistent Calculated Column Formula in Tables:** When selected, flags formulas in columns of cell ranges formatted as tables that vary in their computations from the other formulas in the column.
- **Cells Containing Years Represented as 2 Digits:** When selected, flags as an error all dates entered as text with just the last two digits of the year as errors. (See Book 2, Chapter 1 to find out why this can potentially be a problem.)
- **Numbers Formatted as Text or Preceded by an Apostrophe:** When selected, flags as an error all numbers entered as text.
- **Formulas Inconsistent with Other Formulas in Region:** When selected, flags as an error any formula that differs from the others in the same area of the worksheet.
- **Formulas Which Omit Cells in a Region:** When selected, flags as an error any formula where cells contain data that are adjacent to the range the formula refers to.
- **Unlocked Cells Containing Formulas:** When selected, flags as an error any formula whose cell is unlocked when the worksheet is protected. (See Book 4, Chapter 1 for information on protecting worksheets.)
- **Formulas Referring to Empty Cells:** When selected, flags as an error any formula that refers to blank cells.
- **Data Entered in a Table Is Invalid:** When selected, flags as an error any formulas for which you've set up Data Validation (see Book 2, Chapter 1 for details) and that contain values outside of those defined as valid.

Error tracing

Tracing a formula's family tree, so to speak, with the Trace Precedents and Trace Dependents command buttons on the Ribbon's Formulas tab is fine, as far as it goes. However, when it comes to a formula that returns a hideous error value, such as #VALUE! or #NAME?, you need to turn to Excel's trusty Trace Error option.

To perform error tracing on the current cell, display the Ribbon's Formulas tab and then click the Trace Error option from the Error Checking command's drop-down menu (or press Alt+MKE).

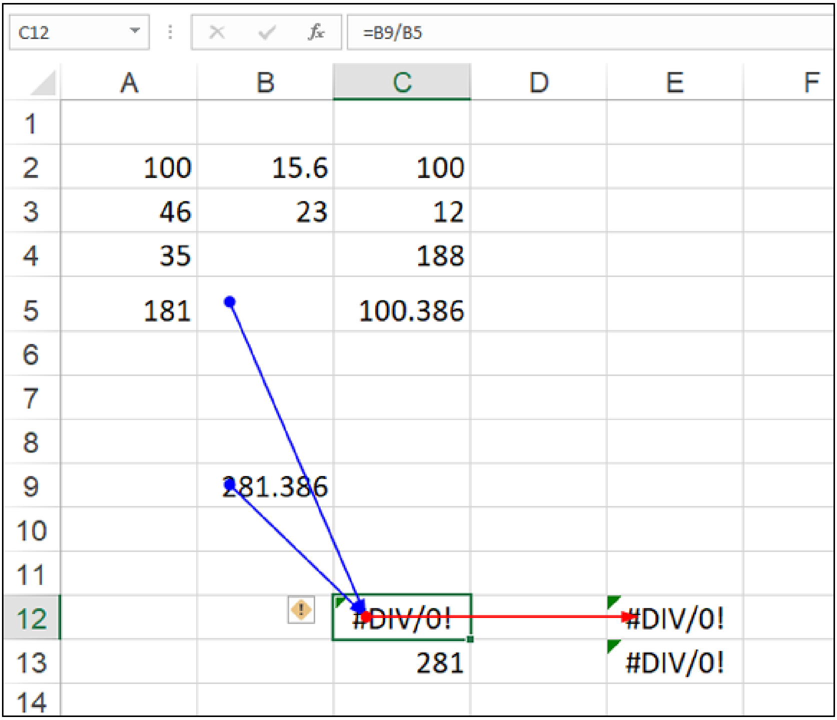
Selecting the Trace Error option is a lot like using both the Trace Precedents and the Trace Dependents command button options, except that the Trace Error option works only when the active cell contains some sort of error value returned by either a bogus formula or a reference to a bogus formula. In tracking down the actual cause of the error value in the active cell (remember that these error values spread to all direct and indirect dependents of a formula), Excel draws blue tracer arrows from the precedents for the original bogus formula and then draws red tracer arrows to all the dependents that contain error values as a result.

Figure 2-12 (sample workbook: Error Tracing.xlsx) shows the sample worksheet after I made some damaging changes that left three cells — C12, E12, and E13 — with #DIV/0! errors (meaning that somewhere, somehow, I ended up creating a formula that is trying to divide by zero, which is a real no-no in the wonderful world of math). To find the origin of these error values and identify its cause, I clicked the Trace Error option on the Error Checking command button's drop-down menu while E12 was the active cell.

WHEN TRACE ERROR LOSES THE TRAIL

The Trace Error option finds errors along the path of a formula's precedents and dependents until it finds either the source of the error or one of the following problems:

- It encounters a branch point with more than one error source. In this case, Excel doesn't make a determination on its own as to which path to pursue.
- It encounters existing tracer arrows. Therefore, *always* click the Remove Arrows command button to get rid of tracer arrows before you click the Trace Error option from the Error Checking button's drop-down menu.
- It encounters a formula with a circular reference. (See Book 3, Chapter 1 for more on circular references.)



C12

=B9/B5

	A	B	C	D	E	F
1						
2	100	15.6	100			
3	46	23	12			
4	35		188			
5	181		100.386			
6						
7						
8						
9		281.386				
10						
11						
12			#DIV/0!		#DIV/0!	
13			281		#DIV/0!	
14						

FIGURE 2-12: Using the Trace Error option to show the precedents and dependents of the formula. (Sample workbook: Error Tracing.xlsx)

You can see the results in Figure 2-12. Note that Excel has selected cell C12, although cell E12 was active when I selected the Trace Error option. To cell C12, Excel has drawn two blue tracer arrows that identify cells B5 and B9 as its direct precedents. From cell C12, the program has drawn a single red tracer arrow from cell C12 to cell E12 that identifies its direct dependent.

As it turns out, Excel's Trace Error option is right on the money because the formula in cell C12 contains the bad apple rotting the whole barrel. I revised the formula in cell C12 so that it divided the value in cell B9 by the value in cell B5 without making sure that cell B5 first contained the SUM formula that totaled the values in the cell range B2:B4. The #DIV/0! error value showed up — remember that an empty cell contains a zero value as if you had actually entered 0 in the cell — and immediately spread to cells E12 and E13, which, in turn, used the value returned in C12 in their own calculations. Thus, these cells were infected with #DIV/0! error values as well.

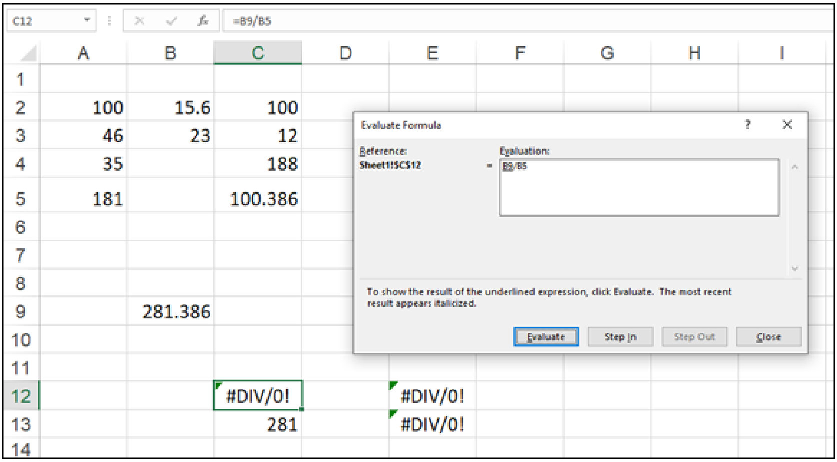
As soon as you correct the problem in the original formula and thus, get rid of all the error values in the other cells, Excel automatically converts the red tracer arrows (showing the proliferation trail of the original error) to regular blue tracer arrows, indicating merely that these restored cells are dependents of the formula that once contained the original sin. You can then remove all the tracer arrows from the sheet by clicking the Remove Arrows command button in the Formula Auditing group of the Ribbon's Formulas tab (or by pressing Alt +MAA).

Evaluating a formula

The Evaluate Formula command button in the Formula Auditing group of the Ribbon's Formulas tab (the one with *fx* inside a magnifying glass) opens the Evaluate Formula dialog box, where you can step through the calculation of a complicated formula to see the current value returned by each part of the calculation. This is often helpful in locating problems that prevent the formula from returning the hoped for or expected results.

To evaluate a formula step-by-step, position the cell pointer in that cell and then click the Evaluate Formula command button on the Formulas tab (or press Alt+MV). This action opens the Evaluate Formula dialog box with an Evaluation list box that displays the contents of the entire formula that's in the current cell.

To have Excel evaluate the first expression or term in the formula (shown underlined in the Evaluation list box) and replace it with the currently calculated value, click the Evaluate button. If this expression uses an argument or term that is itself a result of another calculation, you can display its expression or formula by clicking the Step In button (see Figure 2-13; sample workbook: Error Tracing.xlsx) and then calculate its result by clicking the Evaluate button. After that, you can return to the evaluation of the expression in the original formula by clicking the Step Out button.



	A	B	C	D	E	F	G	H	I
1									
2	100	15.6	100						
3	46	23	12						
4	35		188						
5	181		100.386						
6									
7									
8									
9		281.386							
10									
11									
12			#DIV/0!		#DIV/0!				
13			281		#DIV/0!				
14									

Reference: Sheet1!$C$12 = Evaluation: B9/B5

To show the result of the underlined expression, click Evaluate. The most recent result appears italicized.

FIGURE 2-13: Calculating each part of a formula in the Evaluate Formula dialog box. (Sample workbook: Error Tracing.xlsx)

After you evaluate the first expression in the formula, Excel underlines the next expression or term in the formula (by using the natural order of precedence and a strict left-to-right order unless you have used parentheses to override this order), which you can then replace with its calculated value by clicking the Evaluate button. When you finish evaluating all the expressions and terms of the current formula, you can close the Evaluate Formula dialog box by clicking its Close button in the upper-right corner of the window.

TIP

Instead of the Evaluate Formula dialog box, open the Watch Window dialog box by clicking the Watch Window button on the Formulas tab (Alt+MW) and add formulas to it when all you need to do is to keep an eye on the current value returned by a mixture of related formulas in the workbook. This enables you to see the effect that changing various input values has on their calculations (even when they're located on different sheets of the workbook).

Removing Errors from the Printout

What if you don't have the time to trap all the potential formula errors or track them down and eliminate them before you have to print and distribute the spreadsheet? In that case, you may just have to remove the display of all the error values before you print the report.

To do this, display the Page Layout tab and click the dialog box launcher in the lower-right corner of the Page Setup group. In the Page Setup dialog box, click the Sheet tab and then click the drop-down button attached to the Cell Errors As drop-down list box.

The default value for this drop-down list box is Displayed, meaning that all error values are displayed in the printout exactly as they currently appear in the worksheet. This drop-down list also contains the following items that you can click to remove the display of error values from the printed report:

- Click the <blank> option to replace all error values with blank cells.
- Click the -- option to replace all error values with two dashes.
- Click the #N/A option to replace all error values (except for #N/A entries, of course) with the special #N/A value (which is considered an error value when you select the <blank> or -- options).

REMEMBER Blanking out error values or replacing them with dashes or #N/A values has no effect on them in the worksheet itself, only in any printout you make of the worksheet. You need to view the pages in the Print Preview area in the Print screen in the Backstage view (Ctrl+P) before you can see the effect of selecting an option besides the Displayed option in the Cell Errors As drop-down list box. Also, remember to reset the Cell Errors As option on the Sheet tab of the Page Setup dialog box back to the Displayed option when you want to print a version of the worksheet that shows the error values in all their cells in the worksheet printout.

Chapter 3

Date and Time Formulas

IN THIS CHAPTER

- **Understanding dates and times in Excel**
- **Creating formulas that calculate elapsed dates and times**
- **Using the Date functions**
- **Using the Time functions**

Creating formulas that use dates and times can be a little confusing if you don’t have a good understanding of how Excel treats these types of values. After you’re equipped with this understanding, you can begin to make good use of the many Date and Time functions that the program offers.

This chapter begins with a quick overview of date and time numbers in Excel and how you can use them to build simple formulas that calculate differences between elapsed dates and times. The chapter goes on to survey Excel's built-in Date and Time functions, which enable you to return and calculate with dates and times.

Understanding Dates and Times

Excel doesn’t treat the dates and times that you enter in the cells of your worksheet as simple text entries. (For more information on inputting numbers in a worksheet, see Book 2, Chapter 1.) Any entry with a format that resembles one of the date and time number formats recognized by Excel is automatically converted, behind the scenes, into a serial number. In the case of dates, this serial number represents the number of days that have elapsed since the beginning of the 20th century so that January 1, 1900, is serial number 1; January 2, 1900, is serial number 2; and so forth. In the case of times, this serial number is a fraction that represents the number of hours, minutes, and seconds that have elapsed since midnight, which is serial number 0.0, so that 12:00:00 p.m. (noon) is serial number 0.5; 11:00:00 p.m. is 0.95833333; and so forth.

As long as you format an entry so that it conforms to a recognized date or time format, Excel enters it as a date or time serial number. Only when you enter a formatted date or time as a text entry (by prefacing it with an apostrophe) or import dates and times as text entries into a worksheet do you have to worry about converting them into date and time serial numbers, which enables you to build worksheet formulas that perform calculations on them.

Changing the date locale

Excel isn't set up to automatically recognize European date formats in which the number of the day precedes the number of the month and year. For example, you may want 6/11/2022 to represent November 6, 2022, rather than June 11, 2022. If you're dealing with a worksheet that uses this type of European date system, you have to customize the locale that Excel uses for its Date number formats.

To make this change, you follow these steps:

1. **Select the cells to which you want to apply the new date locale.**
2. **On the Home tab, click the dialog box launcher in the Number group (or press Ctrl+1).**

   Excel opens the Format Cells dialog box with the Number tab displayed.
3. **In the Category list, click Date.**
4. **Use the Locale drop-down list to select the location that uses the date format you want to apply, such as English (United Kingdom).**
5. **Click OK.**

After changing the Date format locale, Excel formats the selected dates according to the new location. If you chose English (United Kingdom), for example, 3/5/22 is interpreted as May 3, 2022, rather than March 5, 2022.

Building formulas that calculate elapsed

dates

Most of the date formulas that you build are designed to calculate the number of days or years that have elapsed between two dates. To do this, you build a formula that subtracts the earlier date from the later date.

For example, if you input the date 4/25/95 in cell B4 and 6/3/22 in cell C4 and you want to calculate the number of days that have elapsed between April 25, 1995, and June 3, 2022, in cell D4, you'd enter the following subtraction formula in that cell:

```
=C4-B4
```

Excel then inputs 9901 as the number of days between these dates in cell D4 using the General number format.

TIP If you want the result between two dates expressed in the number of years rather than the number of days, divide the result of your subtraction by the number of days in a year. In this example, you can enter the formula =D4/365 in cell E4 to return the result 27.12603, which you can then round off to 27 by clicking the Home tab's Decrease Decimal button (it's in the Number group) or by pressing Alt+H9 until only 27 remains displayed in the cell.

Building formulas that calculate elapsed times

Some worksheets require formulas that calculate the amount of elapsed time between a starting and an ending time. For example, suppose that you keep a worksheet that records the starting and stopping times for your hourly employees, and you need to calculate the number of hours and minutes that elapse between these two times to figure their daily and monthly wages.

To build a formula that calculates how much time has elapsed between two different times of the day, subtract the starting time of day from the ending time of day. For example, suppose that you enter a person’s starting time in cell B6 and ending time in C6. In cell D6, you'd enter the following subtraction formula:

```
=C6-B6
```

Excel then returns the difference in cell D6 as a decimal value representing what fraction that difference represents of an entire day (that is, a 24-hour period). If, for example, cell B6 contains a starting time of 9:15 a.m. and cell C6 contains an ending time of 3:45 p.m., Excel returns the following decimal value to cell D6:

```
6:30 AM
```

To convert this time of day into its equivalent decimal number, you convert the time format automatically given to it to the General format (Ctrl+Shift+`), which displays the following result in cell D6:

```
0.270833
```

To convert this decimal number representing the fraction of an entire day into the number of hours that have elapsed, you multiply this result by 24 as in =D6*24, which gives you a result of 6.5 hours.

Using Date Functions

Excel contains a number of built-in Date functions that you can use in your worksheets. You can access the Date functions either via the Insert Function icon on the Formula bar, or via the Ribbon's Formulas tab by clicking the Date & Time drop-down menu. The next few sections take you through a few of the most common Date functions.

TODAY

The most basic Date function has to be TODAY. This function takes no arguments and is always entered as follows:

```
=TODAY()
```

When you enter the TODAY function in a cell or formula, Excel returns the current date using the following Date format:

```
9/15/2022
```

REMEMBER The date inserted into a cell with the TODAY function is not static. Whenever you open a worksheet that contains this function, Excel recalculates the function and updates its contents to the current date. This means that you don’t usually use TODAY to input the current date when you’re doing it for historical purposes (an invoice, for example) and never want it to change.

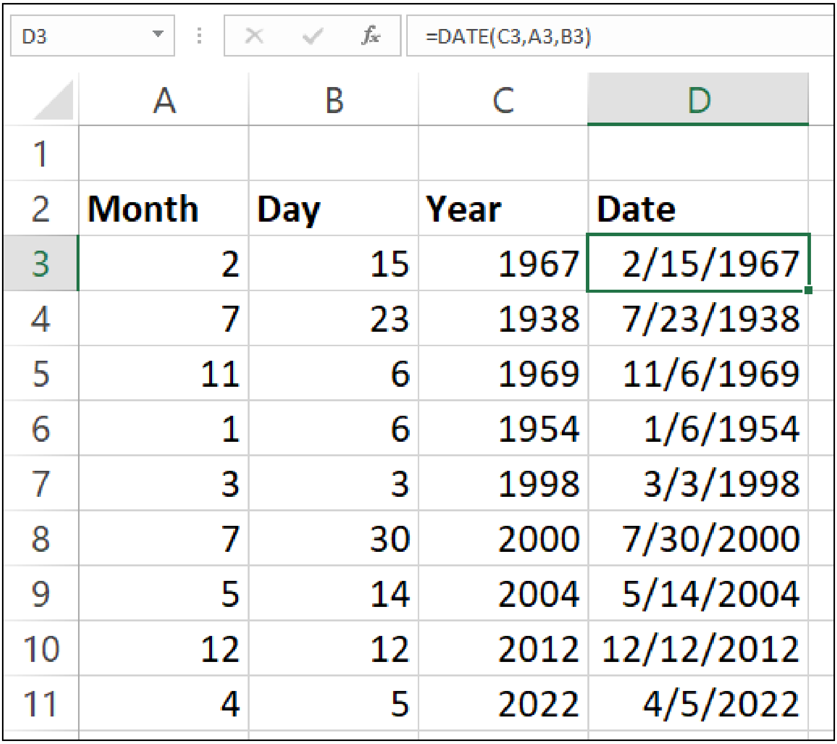
TIP If you do use TODAY and then want to make the current date static in the worksheet, you need to convert the function into its serial number. You can do this for individual cells: First, select the cell, press F2 to activate Edit mode, press F9 to replace =TODAY() with today’s serial number on the Formula bar, and click the Enter button to insert this serial number into the cell. You can do this conversion on a range of cells by selecting the range, copying it to the Clipboard by clicking the Copy button on the Home tab of the Ribbon (or pressing Ctrl+C), and then immediately pasting the calculated values into the same range by choosing the Paste Values option from the Paste command button’s drop-down menu (or pressing Alt+HVV).

DATE and DATEVALUE

The DATE function returns a date serial number given a year, month, and day as arguments. The DATE function uses the following syntax:

```
DATE(year,month,day)
```

This function comes in handy when you have a worksheet that contains the different parts of the date in separate columns, similar to the one shown in Figure 3-1. You can use it to combine the three columns of date information into a single date cell that you can use in sorting and filtering. (See Book 6, Chapters 1 and 2 to find out how to sort and filter data.)



=DATE(C3,A3,B3)

	A	B	C	D
1				
2	**Month**	**Day**	**Year**	**Date**
3	2	15	1967	2/15/1967
4	7	23	1938	7/23/1938
5	11	6	1969	11/6/1969
6	1	6	1954	1/6/1954
7	3	3	1998	3/3/1998
8	7	30	2000	7/30/2000
9	5	14	2004	5/14/2004
10	12	12	2012	12/12/2012
11	4	5	2022	4/5/2022

FIGURE 3-1: Using the DATE function to combine separate date information into a single entry.

The DATEVALUE function returns the date serial number for a date that's been entered into the worksheet as text so that you can use it in date calculations. This function takes a single argument:

```
DATEVALUE(date_text)
```

Suppose, for example, that you've made the following text entry in cell B12:

```
'5/21/2022
```

(Remember that when you preface an entry with an apostrophe, Excel inserts that entry as text even if the program would otherwise treat it as a value.) You can convert this text entry into a date serial number by entering the following formula in cell C12 next door:

```
=DATEVALUE(B12)
```

Excel returns the date serial number, 44702, to cell C12, which you can convert into a more intelligible date by formatting it with one of Excel's Date formats (Ctrl+1).

REMEMBER You must convert the DATE and DATEVALUE functions into their calculated date serial numbers to sort and filter them. To convert these functions individually, select a cell, press F2 to activate Edit mode, and then press F9 to replace the function with the calculated date serial number; finally, click the Enter button on the Formula bar to insert this serial number into the cell. To do this conversion on a range of cells, select the range, copy it to the Clipboard by pressing Ctrl+C, and then immediately paste the calculated serial numbers into the same range by choosing the Paste Values option from the Paste command button's drop-down menu (or press Alt+HVV).

DAY, WEEKDAY, MONTH, and YEAR

The DAY, WEEKDAY, MONTH, and YEAR Date functions all return just parts of the date serial number that you specify as their argument:

- **DAY(*serial_number*):** Returns the day of the month in the date (as a number between 1 and 31).
- **WEEKDAY(*serial_number*, [*return_type*]):** Returns the day of the week (as a number between 1 and 7 or 0 and 6). The optional *return_type* argument is a number between 1 and 3; 1 (or no *return_type* argument) specifies the first type where 1 equals Sunday and 7 equals Saturday; 2 specifies the second type where 1 equals Monday and 7 equals Sunday; and 3 specifies the third type where 0 equals Monday and 6 equals Sunday.
- **MONTH(*serial_number*):** Returns the number of the month in the date serial number (from 1 to 12).
- **YEAR(*serial_number*):** Returns the number of the year (as an integer between 1900 and 9999) in the date serial number.

For example, if you enter the following DAY function in a cell as follows:

```
DAY(DATE(2022, 4, 15))
```

Excel returns the value 15 to that cell. If, instead, you use the WEEKDAY function as follows:

```
WEEKDAY(DATE(2022, 4, 15))
```

Excel returns the value 6, which represents Friday (using the first *return_type* where Sunday is 1 and Saturday is 7) because the optional *return_type* argument isn't specified. (See Book 3, Chapter 2 for an example using the WEEKDAY function as the *expression* argument of the SWITCH function to replace the day numbers (1 – 7) with their corresponding names (Sunday – Saturday).

If you use the MONTH function on this date as in the following:

```
MONTH(DATE(2022, 4, 15))
```

Excel returns 4 to the cell.

WARNING To avoid errors in your date formulas, always enter all four digits of the year. For example, consider the following:

```
DATE(22, 4, 15)
```

This returns the date April 15, 1922, which is probably not what you want.

Note that you can use the YEAR function to calculate the difference in years between two dates. For example, if cell B6 contains 7/23/1978 and cell C6 contains 7/23/2022, you can enter the following formula using the YEAR function to determine the difference in years:

```
=YEAR(C6) - YEAR(B6)
```

Excel then returns 44 to the cell containing this formula.

WARNING Don't use these functions on dates entered as text entries. Always use the DATEVALUE function to convert these text dates and then use the DAY, WEEKDAY, MONTH, or YEAR functions on the serial numbers returned by the DATEVALUE function to ensure accurate results.

DAYS360

The DAYS360 function returns the number of days between two dates based on a 360-day year (that is, one in which there are 12 equal months of 30 days each), which is an accounting convention. The DAYS360 function takes the following arguments:

```
DAYS360(start_date, end_date, [method])
```

The *start_date* and *end_date* arguments are date serial numbers or references to cells that contain such serial numbers. The optional *method* argument is either TRUE or FALSE, where FALSE specifies the use of the U.S. calculation method and TRUE specifies the use of the European calculation method:

- **U.S. (NASD) method (FALSE or *method* argument omitted):** In this method, if the starting date is equal to the 31st of the month, it becomes equal to the 30th of the same month; if the ending date is the 31st of a month and the starting date is earlier than the 30th of the month, the ending date becomes the 1st of the next month; otherwise, the ending date becomes equal to the 30th of the same month.
- **European method (TRUE):** In this method, starting and ending dates that occur on the 31st of a month become equal to the 30th of the same month.

Other useful Date functions

Excel includes a few other Date functions that, while somewhat specialized, may come in handy from time to time. These Date functions expand your ability to do date calculations in the worksheet — especially those calculations that work with standard workdays: Monday through Friday.

EDATE

The EDATE (for Elapsed Date) function calculates a future or past date that is a specified number of months ahead or behind some starting date. You can use the EDATE function to quickly determine the date at a specified interval in the future or past (for example, three months ahead or one month ago).

The EDATE function takes two arguments:

```
EDATE(start_date, months)
```

The *start_date* argument is the date serial number that you want used as the base date. The *months* argument is a positive (for future dates) or negative (for past dates) integer that represents the number of months ahead or months past to calculate.

For example, suppose that you enter the following EDATE function in a cell:

```
=EDATE(DATE(2022, 1, 15), 1)
```

Excel returns the date serial number, 44607, which becomes 2/15/2022 when you apply the m/d/yyyy Date format.

Note that EDATE “rounds” off some calculations to the end of the month. For example, consider the following formula:

```
=EDATE(DATE(2022, 3, 31), 1)
```

Excel returns the date serial number, 44681, which becomes 4/30/2022 when you apply the m/d/yyyy Date format. That is, because there's no such date as April 31, 2022, EDATE “rounds” the result to the valid date April 30, 2022.

EOMONTH

The EOMONTH (for End of Month) function calculates the last day of the month that is a specified months ahead or behind a starting date. You can use the EOMONTH function to quickly determine the end of the month at a set interval in the future or past.

For example, suppose that you enter the following EOMONTH function in a cell:

```
=EOMONTH(DATE(2022, 1, 1), 1)
```

Excel returns the date serial number, 44620, which becomes 2/28/2022 when you apply the m/d/yyyy Date format.

NETWORKDAYS

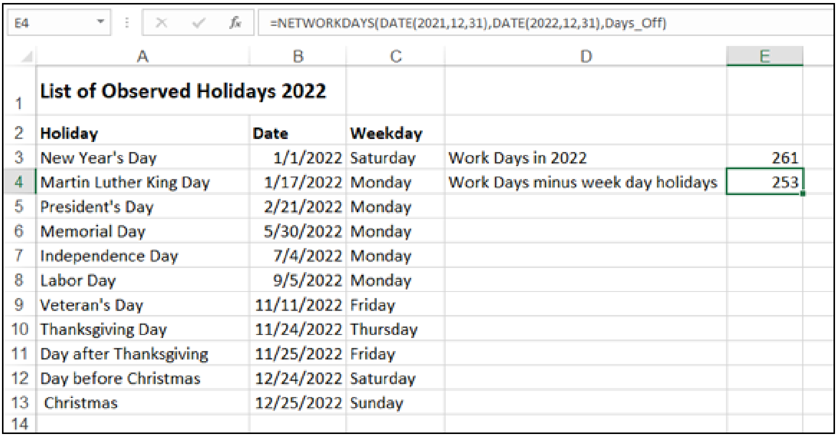
The NETWORKDAYS function returns the number of workdays that exist between a starting date and ending date that you specify as arguments:

```
NETWORKDAYS(start_date, end_date, [holidays])
```

When using this function, you can also specify a cell range in the worksheet or array constant to use as an optional *holidays* argument that lists the state, federal, and floating holidays observed by your company. Excel then excludes any dates listed in the *holidays* argument when they occur in between *start_date* and *end_date* arguments.

Figure 3-2 (sample workbook: Work Days.xlsx) illustrates how this function works. In this worksheet, I created a list in the cell range B3:B13 with all the observed holidays in the calendar year 2022 and named this range Days_Off. I then entered the following NETWORKDAYS function in cell E4:

```
NETWORKDAYS(DATE(2021, 12, 31), DATE(2022, 12, 31), Days_Off)
```



E4

=NETWORKDAYS(DATE(2021,12,31),DATE(2022,12,31),Days_Off)

	A	B	C	D	E
1	**List of Observed Holidays 2022**				
2	**Holiday**	**Date**	**Weekday**		
3	New Year's Day	1/1/2022	Saturday	Work Days in 2022	261
4	Martin Luther King Day	1/17/2022	Monday	Work Days minus week day holidays	253
5	President's Day	2/21/2022	Monday		
6	Memorial Day	5/30/2022	Monday		
7	Independence Day	7/4/2022	Monday		
8	Labor Day	9/5/2022	Monday		
9	Veteran's Day	11/11/2022	Friday		
10	Thanksgiving Day	11/24/2022	Thursday		
11	Day after Thanksgiving	11/25/2022	Friday		
12	Day before Christmas	12/24/2022	Saturday		
13	Christmas	12/25/2022	Sunday		
14					

FIGURE 3-2: Using the NETWORKDAYS function to find the number of workdays between two dates. (Sample workbook: Work Days.xlsx)

The preceding function calculates the number of workdays between December 31, 2021, and December 31, 2022 (261 total work days), and then subtracts the dates listed in the cell range Days_Off (B3:B13) if they fall on a weekday. Because eight of the holidays in the Days_Off range happen to fall on a weekday in the year 2022, the number of workdays between December 31, 2021, and December 31, 2022, is calculated as 253 in cell E4 (261–8 = 253).

WEEKNUM

The WEEKNUM function returns a number indicating where the week in a specified date falls within the year. This function takes the following arguments:

```
WEEKNUM(serial_number, [return_type])
```

In this function, the *serial_number* argument is the date whose week in the year you want to determine. The optional *return_type* argument is 1 or 2, where 1 indicates that the new week begins on Sunday and weekdays are numbered from 1 to 7, and 2 indicates that the new week begins on Monday and that weekdays are also numbered from 1 to 7.

Note that even if the first week of the year contains just a single day, that week is considered week 1 from the WEEKNUM function's perspective. For example, if you enter the following WEEKNUM function in a cell:

```
=WEEKNUM(DATE(2022, 1, 23))
```

Excel returns the number 5, indicating that the week containing the date January 23, 2022, is the fifth week in the year when Sunday is considered as the first day of the week. January 23, 2022 falls on a Sunday and, if you look at a calendar, it appears to be only the fourth Sunday of the year. But look closer and you see that January 1, 2022 falls on a Saturday, so the week that includes January 1, 2022 (which technically begins on Sunday, December 27, 2021) is considered to be week 1.

Note that if I had added 2 as the optional *return-type* argument, Excel would return 4 as the result because January 23, 2022, is deemed to fall on the last day of the fourth week of the year when Monday is considered the first day of the week.

WORKDAY

You can use the WORKDAY function to find out the date that is a specified number of workdays before or after a starting date. This function takes the following arguments:

```
WORKDAY(start_date, days, [holidays])
```

The *start_date* argument is the initial date that you want used in calculating the date of the workday that falls so many days before or after it. The *days* argument is the number of workdays ahead (positive integer) or behind (negative integer) the *start_date*. The optional *holidays* argument is an array constant or cell range that contains the dates of the holidays that should be excluded (when they fall on a weekday) in calculating the new date.

For example, suppose that you want to determine a due date for a report that is 30 workdays after February 1, 2022, by using the same holiday schedule entered in the cell range named Days_Off (B3:B13) in the Work Days 2022 workbook, shown in Figure 3-2. To do this, you enter the following formula:

```
=WORKDAY(DATE(2022, 2, 1), 30, Days_Off)
```

Excel then returns the serial number 44636 to the cell, which then appears as 3/16/2022, when you format it with the Short Date format.

YEARFRAC

The YEARFRAC (for Year Fraction) function enables you to calculate the fraction of the year, which is computed from the number of days between two dates. You can use the YEARFRAC function to determine the proportion of a whole year's benefits or obligations to assign to a specific period.

The YEARFRAC function uses the following arguments:

```
YEARFRAC(start_date, end_date, [basis])
```

The optional *basis* argument in the YEARFRAC function is a number between 0 and 4 that determines the day count basis to use in determining the fractional part of the year:

- 0 (or omitted) to base it on the U.S. (NASD) method of 30/360 (see "DAYS360" earlier in the chapter for details on the U.S. method)
- 1 to base the fraction on actual days/actual days
- 2 to base the fraction on actual days/360
- 3 to base the fraction on actual days/365
- 4 to base the fraction on the European method of 30/360 (see "DAYS360" earlier in the chapter for details on the European method)

For example, if you enter the following YEARFRAC formula in a cell to find what percentage of the year remains as of October 15, 2022:

```
=YEARFRAC(DATE(2022, 10, 15),DATE(2022, 12, 31))
```

Excel returns the decimal value 0.2111111 to the cell, indicating that just over 21 percent of the year remains.

Using Time Functions

Excel offers far fewer Time functions when compared with the wide array of Date functions. Like the Date functions, however, the Time functions enable you to convert text entries representing times of day into time serial numbers so that you can use them in calculations. The Time functions also include functions for combining different parts of a time into a single serial time number, as well as those for extracting the hours, minutes, and seconds from a single time serial number. You can access the Time functions either via the Insert Function icon on the Formula bar, or via the Ribbon's Formulas tab by clicking the Date & Time drop-down menu. The next few sections take you through a few of the most common Time functions.

NOW

The NOW function returns the current date and time based on your computer’s internal clock. You can use the NOW function to date- and time-stamp the worksheet. Like the TODAY function, NOW takes no arguments and is automatically recalculated every time you open the worksheet:

```
=NOW()
```

When you enter the NOW function in a cell, Excel puts the date before the current time. It also formats the date with the Short Date format and the time with the 24-hour Time format. So, if the current date were August 19, 2022 and the current time was 12:57 p.m. at the moment when Excel calculates the NOW function, your cell would contain the following entry:

```
8/19/2022 12:57
```

TIP

Note that the combination Date/Time format that the NOW function uses is a custom number format. If you want to assign a different date/time to the date and time serial numbers returned by this function, you have to create your own custom number format and then assign it to the cell that contains the NOW function. (See Book 2, Chapter 2 for information on creating custom number formats.)

TIME and TIMEVALUE

Given values representing the hour, minute, and second, the TIME function returns a decimal number representing the time serial number, ranging from 0 (zero) to 0.99999999, representing time 0:00:00 (12:00:00 AM) to 23:59:59 (11:59:59 PM). You can use the TIME function to combine the hours, minutes, and seconds of a time into a single time serial number when these parts are stored in separate cells.

The TIME function takes the following arguments:

```
TIME(hour, minute, second)
```

When specifying the *hour* argument, you use a number between 0 and 23. (Any number greater than 23 is divided by 24, and the remainder is used as the hour value.) When specifying the *minute* and *second* arguments, you use a number between 0 and 59. (Any *minute* argument greater than 59 is converted into hours and minutes, just as any *second* argument greater than 59 is converted into hours, minutes, and seconds.)

For example, if cell A3 contains 4, cell B3 contains 37, and cell C3 contains 0, and you enter the following TIME function in cell D3:

```
=TIME(A3, B3, C3)
```

Excel enters 4:37 AM in cell D3. If you then assign the General number format to this cell (Ctrl+Shift+` or Ctrl+~), it would then contain the time serial number, 0.192361.

The TIMEVALUE function converts a time entered or imported into the worksheet as a text entry into its equivalent time serial number so that you can use it in time calculations. The TIMEVALUE function uses a single *time_text* argument as follows:

```
TIMEVALUE(time_text)
```

So, for example, if you put the following TIMEVALUE function in a cell to determine the time serial number for 10:35:25:

```
=TIMEVALUE("10:35:25")
```

Excel returns the time serial number 0.441262 to the cell. If you then assign the first Time number format to this cell, the decimal number appears as 10:35:25 a.m. in the cell.

HOUR, MINUTE, and SECOND

The HOUR, MINUTE, and SECOND functions on the Date & Time command button's drop-down menu enable you to extract specific parts of a time value in the worksheet. Each of these three Time functions takes a single *serial_number* argument that contains the hour, minute, or second that you want to extract.

So, for example, if cell B5 contains the time 1:30:10 p.m. (otherwise known as serial number 0.5626157) and you enter the following HOUR function in cell C5:

```
=HOUR(B5)
```

Excel returns 13 as the hour to cell C5 (hours are always returned in 24-hour time). If you then enter the following MINUTE function in cell D5:

```
=MINUTE(B5)
```

Excel returns 30 as the number of minutes to cell D5. Finally, if you enter the following SECOND function in cell E5:

```
=SECOND(B5)
```

Excel returns 10 as the number of seconds to cell E5.

Chapter 4

Finagling Financial Formulas

IN THIS CHAPTER

- **Using basic investment functions**
- **Using basic depreciation functions**
- **Using basic currency conversion functions**

A *killer app* is a software program so good or so useful that it justifies the price of whatever platform it runs on. Back in the late 1970s, the Apple II computer found its killer app in the VisiCalc spreadsheet program. A few years later, the original IBM PC's killer app was the Lotus 1-2-3 spreadsheet software. Yep, that's right: The early history of personal computing was pretty much defined by people desperately wanting to digitize their company or personal finances.

Forty years later, nothing has changed. Sure, VisiCalc and Lotus 1-2-3 have bit the digital dust, but folks like you and me still spend a ton of time wrestling with financial data stored in spreadsheets. Those spreadsheet financial models are now mostly stored in Excel workbooks. And no wonder: Excel not only lets you add, subtract, multiple, and divide financial values. but it also offers a sophisticated toolkit of financial functions. Excel’s financial prowess includes functions for determining such things as the present, future, or net present value of an investment; the payment, number of periods, or the principal or interest part of a payment on an amortized loan; the rate of return on an investment; or the depreciation of your favorite assets.

Excel also comes with quite a few advanced financial functions that cover such highly specialized use cases as calculating the accrued interest for a security paying interest periodically and only at maturity, and calculating the internal rate of return and the net present value for a schedule of nonperiodic cash flows.

Some Financial Function Basics Before You Begin

The key to using any of Excel's financial functions is to understand the terminology used by their arguments. Many of the most common financial functions, such as PV (Present Value), NPV (Net Present Value), FV (Future Value), PMT (Payment), and IPMT (Interest Payment) take similar arguments:

- **PV:** The present value of a loan or investment. For a loan, PV is the principal (that is, the amount borrowed); for an investment, PV is the amount initially deposited into the investment.
- **FV:** The future value of a loan or investment. For a loan, FV is the principal that remains at the end of the term; for an investment, FV is the total amount in the investment at the end of the term (the original deposit plus interest).
- **PMT:** The payment made each period for a loan or investment. For a loan, PMT is usually set over the term of the loan and includes principal plus interest; for an investment, PMT is the amount you deposit each period.
- **RATE:** The interest rate for a loan or investment. Normally, the rate is expressed as an annual percentage.
- **NPER:** The total number of payment periods in the term of the loan or investment. You calculate this number by taking the Term (the amount of time that interest is paid) and multiplying it by the Period (the point in time when interest is paid or earned) so that a loan with a 3-year term with 12 monthly interest payments has 3 x 12, or 36 payment periods.

REMEMBER When using financial functions, keep in mind that the *fv, pv,* and *pmt* arguments can be positive or negative, depending on whether you're receiving the money (as in the case of an investment) or paying out the money (as in the case of a loan).

REMEMBER Also keep in mind that you want to express the *rate* argument in the same time units as the *nper* argument. If *rate* is an annual percentage, then *nper* must be expressed in years; if *nper* is expressed in months, *rate* must be a monthly percentage. For example, suppose you make monthly payments on a 30-year mortgage, so you express *nper* as the total number of monthly payments, which is 360 (30 x 12). To get accurate results in your mortgage calculations, you need to express the annual interest rate in monthly terms as well. For example, if you pay an annual interest rate of 3 percent on the loan, you express the *rate* argument as 0.03/12 so that it is monthly as well.

The PV, NPV, and FV Functions

The PV (Present Value), NPV (Net Present Value), and FV (Future Value) functions — all found on the Ribbon's Formulas tab in the Financial button's drop-down menu (Alt+MI) — enable you to determine the profitability of an investment.

Calculating the Present Value

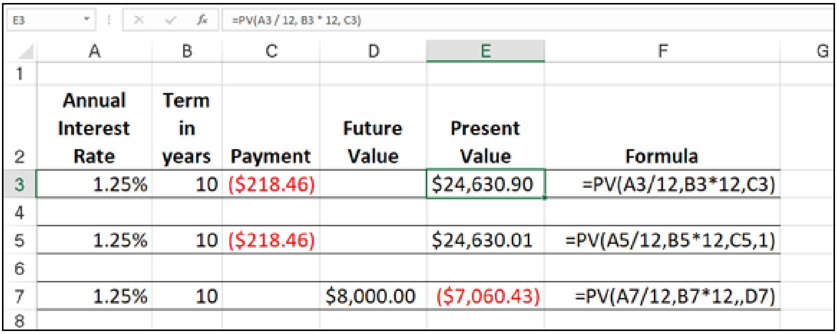
The PV, or Present Value, function returns the present value of an investment, which is the total amount that a series of future payments is worth presently. The syntax of the PV function is as follows:

```
=PV(rate, nper, pmt,[fv],[type])
```

The *fv* and *type* arguments are optional arguments in the function (indicated by the square brackets). The *fv* argument is the future value or cash balance that you want to have after making your last payment. If you omit the *fv* argument, Excel assumes a future value of zero (0). The *type* argument indicates whether the payment is made at the beginning or end of the period: Enter 0 (or omit the *type* argument) when the payment is made at the end of the period, and use 1 when it is made at the beginning of the period.

Figure 4-1 (sample workbook: Present Value Examples.xlsx) contains several examples using the PV function. All three PV functions use the same annual percentage rate of 1.25 percent and term of 10 years. Because payments are made monthly, each function converts these annual figures into monthly ones. For example, in the PV function in cell E3, the annual interest rate in cell A3 is converted into a monthly rate by dividing by 12 (A3/12). The annual term in cell B3 is converted into equivalent monthly periods by multiplying by 12 (B3 x 12).

Note that although the PV functions in cells E3 and E5 use the *rate, nper,* and *pmt* ($218.46) arguments, their results are slightly different. This is caused by the difference in the *type* argument in the two functions: the PV function in cell E3 assumes that each payment is made at the end of the period (the *type* argument is 0 whenever it is omitted), whereas the PV function in cell E5 assumes that each payment is made at the beginning of the period (indicated by a *type* argument of 1). When the payment is made at the beginning of the period, the present value of this investment is $0.89 higher than when the payment is made at the end of the period, reflecting the interest accrued during the last period.



	A	B	C	D	E	F	G
1							
2	Annual Interest Rate	Term in years	Payment	Future Value	Present Value	Formula	
3	1.25%	10	($218.46)		$24,630.90	=PV(A3/12,B3*12,C3)	
4							
5	1.25%	10	($218.46)		$24,630.01	=PV(A5/12,B5*12,C5,1)	
6							
7	1.25%	10		$8,000.00	($7,060.43)	=PV(A7/12,B7*12,,D7)	
8							

FIGURE 4-1: Using the PV function to calculate the present value of various investments. (Sample workbook: Present Value Examples.xlsx)

The third example in cell E7 (shown in Figure 4-1) uses the PV function with an *fv* argument and no *pmt* argument. In this example, the PV function tells you that if you wanted to have $8,000 at the end of a 10-year investment that pays monthly interest at an annual rate of 1.25 percent, you would have to make an initial deposit of $7,060.43. Note that when you use the PV function without the *pmt* argument, you must still indicate the position of the *pmt* argument in the function with a comma (thus the two commas in a row in the function) so that Excel does not mistake your *fv* argument for the *pmt* argument.

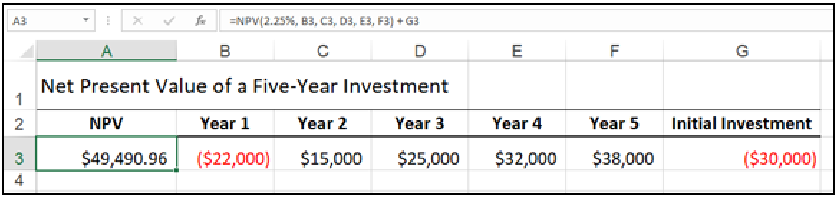
Calculating the Net Present Value

The NPV function calculates the net present value based on a series of cash flows. The syntax of this function is

```
=NPV(rate, value1, [value2], […])
```

where *value1, value2,* and so on are between 1 and 13 value arguments representing a series of payments (negative values) and income (positive values), each of which is equally spaced in time and occurs at the end of the period. The NPV investment begins one period before the period of the *value1* cash flow and ends with the last cash flow in the argument list. If your first cash flow occurs at the beginning of the period, you must add it to the result of the NPV function rather than include it as one of the arguments.

Figure 4-2 (sample workbook: Net Present Value Example.xlsx) illustrates the use of the NPV function to evaluate the attractiveness of a five-year investment that requires an initial investment of $30,000 (the value in cell G3). The first year, you expect a loss of $22,000 (cell B3); the second year, a profit of $15,000 (cell C3); the third year, a profit of $25,000 (cell D3); the fourth year, a profit of $32,000 (cell E3); and the fifth year, a profit of $38,000 (cell F3). Note that these cell references are used as the *value* arguments of the NPV function.



A3

=NPV(2.25%, B3, C3, D3, E3, F3) + G3

	A	B	C	D	E	F	G
1	Net Present Value of a Five-Year Investment						
2	NPV	Year 1	Year 2	Year 3	Year 4	Year 5	Initial Investment
3	$49,490.96	($22,000)	$15,000	$25,000	$32,000	$38,000	($30,000)
4							

FIGURE 4-2: Using the NPV function to calculate the net present value of an investment. (Sample workbook: Net Present Value Example.xlsx)

Unlike when using the PV function, the NPV function doesn't require an even stream of cash flows. The *rate* argument in the function is set at 2.25 percent. In this example, this represents the *discount rate* of the investment — that is, the interest rate that you may expect to get during the five-year period if you put your money into some other type of investment, such as a high-yield money-market account. This NPV function in cell A3 returns a net present value of $49,490.96, indicating that you can expect to realize a great deal more from investing your $30,000 in this investment than you possibly could from investing the money in a money-market account at the interest rate of 2.25 percent.

Calculating the Future Value

The FV function calculates the future value of an investment. The syntax of this function is

```
=FV(rate, nper, pmt, [pv], [type])
```

The *rate, nper, pmt,* and *type* arguments are the same as those used by the PV function. The *pv* argument is the present value or lump-sum amount for which you want to calculate the future value. As with the *fv* and *type* arguments in the PV function, both the *pv* and *type* arguments are optional in the FV function. If you omit these arguments, Excel assumes their values to be zero (0) in the function.

You can use the FV function to calculate the future value of an investment, such as an IRA (Individual Retirement Account). For example, suppose that you establish an IRA at age 43 and will retire 22 years from now at age 65 and that you plan to make annual payments into the IRA at the beginning of each year. If you assume a rate of return of 2.5 percent a year, you'd enter the following FV function in your worksheet:

```
=FV(2.5%, 22, -1500, , 1)
```

Excel then indicates that you can expect a future value of $44,376.64 for your IRA when you retire at age 65. If you had established the IRA a year prior and the account already has a present value of $1,538, you would amend the FV function as follows:

```
=FV(2.5%, 22, -1500, -1538, 1)
```

In this case, Excel indicates that you can expect a future value of $47,024.42 for your IRA at retirement.

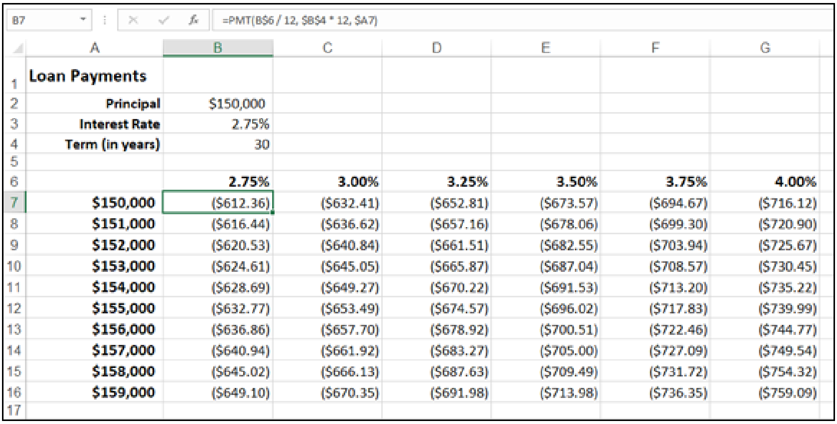
The PMT Function

The PMT function calculates the periodic payment for a loan or investment, assuming a stream of equal payments and a constant rate of interest. The PMT function uses the following syntax:

```
=PMT(rate, nper, pv, [fv], [type])
```

As with the other common financial functions, *rate* is the interest rate per period, *nper* is the number of periods, *pv* is the present value or the amount the future payments are worth presently, *fv* is the future value or cash balance that you want after the last payment or deposit is made (Excel assumes a future value of zero when you omit this optional argument as you would when calculating loan payments), and *type* is the value 0 for payments made at the end of the period or the value 1 for payments or deposits made at the beginning of the period. (If you omit the optional *type* argument, Excel assumes that the payment or deposit is made at the end of the period.)

The PMT function is often used to calculate the payment for mortgage loans that have a fixed rate of interest. Figure 4-3 (sample workbook: Loan Payments.xlsx) shows a sample worksheet that contains a table using the PMT function to calculate loan payments for a range of interest rates (from 2.75 percent to 4.00 percent) and principals ($150,000 to $159,000). The table uses the initial principal that you enter in cell B2, copies it to cell A7, and then increases it by $1,000 in the range A8:A16. The table uses the initial interest rate that you enter in cell B3, copies it to cell B6, and then increases this initial rate by 1/4 of a percent in the range C6:G6. The term in years in cell B4 is a constant factor that is used in the entire loan payment table.



=PMT(B$6 / 12, $B$4 * 12, $A7)

	A	B	C	D	E	F	G
1	**Loan Payments**						
2	**Principal**	$150,000					
3	**Interest Rate**	2.75%					
4	**Term (in years)**	30					
5							
6		**2.75%**	**3.00%**	**3.25%**	**3.50%**	**3.75%**	**4.00%**
7	**$150,000**	($612.36)	($632.41)	($652.81)	($673.57)	($694.67)	($716.12)
8	**$151,000**	($616.44)	($636.62)	($657.16)	($678.06)	($699.30)	($720.90)
9	**$152,000**	($620.53)	($640.84)	($661.51)	($682.55)	($703.94)	($725.67)
10	**$153,000**	($624.61)	($645.05)	($665.87)	($687.04)	($708.57)	($730.45)
11	**$154,000**	($628.69)	($649.27)	($670.22)	($691.53)	($713.20)	($735.22)
12	**$155,000**	($632.77)	($653.49)	($674.57)	($696.02)	($717.83)	($739.99)
13	**$156,000**	($636.86)	($657.70)	($678.92)	($700.51)	($722.46)	($744.77)
14	**$157,000**	($640.94)	($661.92)	($683.27)	($705.00)	($727.09)	($749.54)
15	**$158,000**	($645.02)	($666.13)	($687.63)	($709.49)	($731.72)	($754.32)
16	**$159,000**	($649.10)	($670.35)	($691.98)	($713.98)	($736.35)	($759.09)
17							

FIGURE 4-3: Loan Payments table using the PMT function to calculate various loan payments. (Sample workbook: Loan Payments.xlsx)

To learn how to build this type of loan payment table with the PMT function, follow these steps for creating it in a new worksheet:

1. **Enter the titles** Loan Payments **in cell A1,** Principal **in cell A2,** Interest Rate **in cell A3,** and Term (in years) **in cell A4.**
2. **Enter** $150,000 **in cell B2, enter** 2.75% **in cell B3, and enter** 30 **in cell B4.**

   You build the Loan Payments table with these starting values.

3. **Position the cell pointer in B6 and then build the formula =B3.**

   By creating a linking formula that brings forward the starting interest rate value in B3 with the formula, you ensure that the interest rate value in B6 will immediately reflect any change that you make in cell B3.

4. **Position the cell pointer in cell C6 and then build the formula =B6 + .25%.**

   By adding 1/4 of a percent to the interest rate to the value in B6 with the formula =B6 + 0.25% in C6 rather than creating a series with the AutoFill handle, you ensure that the interest rate value in cell C6 is 1/4 of a percent larger than any interest rate value entered in cell B6.

5. **Drag the Fill handle in cell C6 to extend the selection to the right to cell G6.**

6. **Position the cell pointer in cell A7 and then build the formula =B2.**

   Again, by using the formula =B2 to bring the initial principal forward to cell A7, you ensure that cell A7 always has the same value as cell B2.

7. **Position the cell pointer in A8 and then build the formula =A7 + 1000.**

   Here too, you use the formula =A7 + 1000 rather than create a series with the AutoFill feature so that the principal value in A8 will always be $1,000 greater than any value placed in cell A7.

8. **Drag the Fill handle in cell A8 down until you extend the selection to cell A16 and then release the mouse button.**

9. **In cell B7, click the Insert Function button on the Formula bar, select Financial from the Or Select a Category drop-down list, and then double-click**

the PMT function in the Select a Function list box.

The Function Arguments dialog box that opens allows you to specify the *rate, nper,* and *pv* arguments. Be sure to move the Function Arguments dialog box to the right so that no part of it obscures the data in columns A and B of your worksheet before proceeding with the following steps for filling in the arguments.

10. **Click cell B6 to insert B6 in the Rate text box and then press F4 twice to convert the relative reference B6 to the mixed reference B$6 (column relative, row absolute) before you type** /12.

    You convert the relative cell reference B6 to the mixed reference B$6 so that Excel does *not* adjust the row number when you copy the PMT formula down each row of the table, but it *does* adjust the column letter when you copy the formula across its columns. Because the initial interest rate entered in B3 (and then brought forward to cell B6) is an *annual* interest rate, but you want to know the *monthly* loan payment, you need to convert the annual rate to a monthly rate by dividing the value in cell B6 by 12.

11. **Click the Nper text box, click cell B4 to insert this cell reference in this text box, and then press F4 once to convert the relative reference B4 to the absolute reference $B$4 before you type** * 12.

    You need to convert the relative cell reference B4 to the absolute reference $B$4 so that Excel adjusts neither the row number nor the column letter when you copy the PMT formula down the rows and across the columns of the table. Because the term is an *annual* period, but you want to know the *monthly* loan payment, you need to convert the yearly periods to monthly periods by multiplying the value in cell B4 by 12.

12. **Click the PV text box, click A7 to insert this cell reference in this text box, and then press F4 three times to convert the relative reference A7 to the mixed reference $A7 (column absolute, row relative).**

    You need to convert the relative cell reference A7 to the mixed reference $A7 so that Excel won't adjust the column letter when you copy the PMT formula across each column of the table, but adjusts the row number when you copy the formula down across its rows.

13. **Click OK to insert the formula =PMT(B$6 / 12, $B $4 * 12, $A7) in cell B7.**

    Now you're ready to copy this original PMT formula down and then over to fill in the entire Loan Payments table.

14. **Drag the Fill handle on cell B7 down until you extend the fill range to cell B16 and then release the mouse button.**

    After you've copied the original PMT formula down to cell B16, you're ready to copy it to the right to G16.

15. **Drag the Fill handle to the right until you extend the fill range B7:B16 to cell G16 and then release the mouse button.**

After copying the original formula with the Fill handle, be sure to widen columns B through G sufficiently to display their results. (You can do this in one step by dragging through the headers of these columns and then double-clicking the right border of column G.)

After you've created a loan table like this, you can then change the beginning principal or interest rate, as well as the term to see what the payments would be under various other scenarios. You can also turn on manual recalculation so that you can control when the Loan Payments table is recalculated.

For information on how to switch to manual recalculation and use this mode to control when formulas are recalculated, see Book 3, Chapter 1. For information on how to protect the worksheet so that users can input new values only into the three input cells (B2, B3, and B4) to change the starting loan amount, interest rate, and the term of the loan, see Book 4, Chapter 1.

Depreciation Functions

Excel offers several depreciation functions, each of which uses a slightly different method for depreciating an asset over time. You can find these built-in depreciation functions on the Ribbon's Formulas tab, in the Financial button’s drop-down menu. Here are the four most commonly used depreciation functions:

- SLN(*cost, salvage, life*): Calculates straight-line depreciation
- SYD(*cost, salvage, life, per*): Calculates sum-of-years-digits depreciation
- DB(*cost, salvage, life, period,* [*month*]): Calculates declining balance depreciation
- DDB(*cost, salvage, life, period,* [*factor*]): Calculates double-declining balance depreciation

As you can see, with the exception of the optional *month* argument in the DB function and the optional *factor* argument in the DDB function, all the depreciation functions require the *cost, salvage,* and *life* arguments, and all but the SLN function require a *period* argument as well:

- *Cost* is the initial cost of the asset that you’re depreciating.
- *Salvage* is the value of the asset at the end of the depreciation (also known as the salvage value of the asset).
- *Life* is the number of periods over which the asset is depreciating (also known as the useful life of the asset).
- *Per* or *period* is the period over which the asset is being depreciated. The units that you use in the *period* argument must be the same as those used in the *life* argument of the depreciation function so that if you express the life argument in years, you must also express the *period* argument in years.

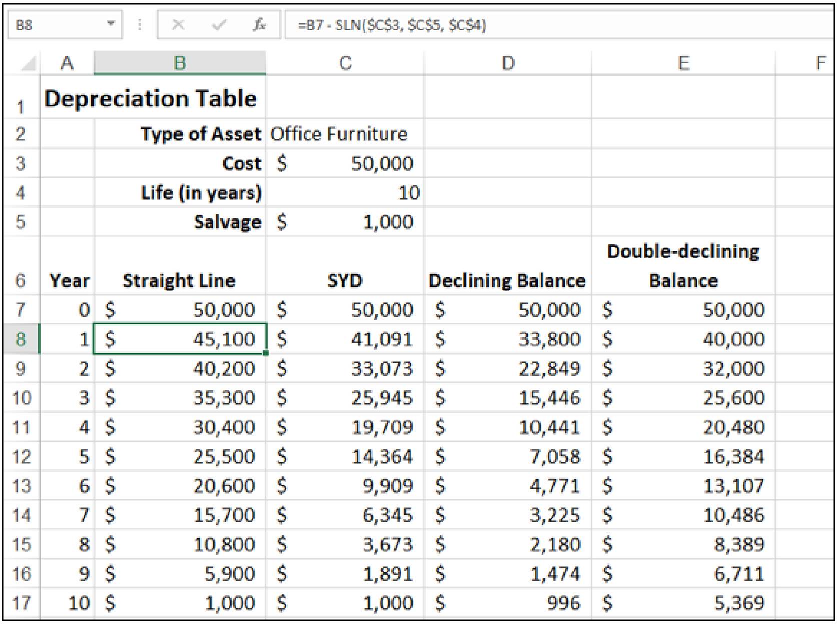
Note that the DB function accepts an optional *month* argument. This argument is the number of months that the asset is in use in the first year. If you omit the *month* argument from your DB function, Excel assumes the number of months of service to be 12.

When using the DDB function to calculate the double-declining balance method of depreciation, you can add an optional *factor* argument. This argument is the rate at which the balance declines in the depreciation schedule. If you omit this optional *factor* argument, Excel assumes the rate to be 2 (thus, the name *double-declining balance*).

Figure 4-4 (sample workbook: Depreciation Table.xlsx) contains a Depreciation table that uses all four depreciation methods to calculate the depreciation of office furniture originally costing $50,000 to be depreciated over a 10-year period, assuming a salvage value of $1,000 at the end of this depreciation period.

The Formula bar shown in Figure 4-4 shows the SLN formula that I entered into cell B8:

```
=B7 – SLN($C$3, $C$5, $C$4)
```



=B7 - SLN($C$3, $C$5, $C$4)

	A	B	C	D	E	F
1	**Depreciation Table**					
2		**Type of Asset**	Office Furniture			
3		**Cost**	$ 50,000			
4		**Life (in years)**	10			
5		**Salvage**	$ 1,000			
6	**Year**	**Straight Line**	**SYD**	**Declining Balance**	**Double-declining Balance**	
7	0	$ 50,000	$ 50,000	$ 50,000	$ 50,000	
8	1	$ 45,100	$ 41,091	$ 33,800	$ 40,000	
9	2	$ 40,200	$ 33,073	$ 22,849	$ 32,000	
10	3	$ 35,300	$ 25,945	$ 15,446	$ 25,600	
11	4	$ 30,400	$ 19,709	$ 10,441	$ 20,480	
12	5	$ 25,500	$ 14,364	$ 7,058	$ 16,384	
13	6	$ 20,600	$ 9,909	$ 4,771	$ 13,107	
14	7	$ 15,700	$ 6,345	$ 3,225	$ 10,486	
15	8	$ 10,800	$ 3,673	$ 2,180	$ 8,389	
16	9	$ 5,900	$ 1,891	$ 1,474	$ 6,711	
17	10	$ 1,000	$ 1,000	$ 996	$ 5,369	

FIGURE 4-4: A Depreciation table showing 10-year depreciation of an asset using various methods. (Sample workbook: Depreciation Table.xlsx)

This formula subtracts the amount of straight-line depreciation to be taken in the first year of service from the original cost of $50,000. (This value is brought forward from cell C3 by the formula =C3.) After creating this original formula in cell B8, I then used the Fill handle to copy it down to cell B17, which contains the final salvage value of the asset in the 10th year of service.

Cell C8 contains a similar formula for calculating the sum-of-years-digits depreciation for the office furniture. This cell contains the following formula:

```
=C7 - SYD($C$3, $C$5, $C$4, $A8)
```

This formula subtracts the amount of sum-of-years-digits depreciation to be taken at the end of the first year from the original cost of $50,000 in cell C7 (also brought forward from cell C3 by the formula =C3). After creating this original formula in cell C8, I again used the Fill handle to copy it down to cell C17, which also contains the final salvage value of the asset in the 10th year of service.

I used the same basic procedure to create the formulas using the DB and DDB depreciation methods in the cell ranges D8:D17 and E8:E17, respectively. Cell D8 contains the following DB formula:

```
=D7 - DB($C$3, $C$5, $C$4, $A8)
```

Cell E8 contains the following DDB formula:

```
=E7 - DDB($C$3, $C$5, $C$4, $A8)
```

Note that, like the SYD function, both of these depreciation functions require the use of a *period* argument, which is supplied by the list of years in the cell range A8:A17. Note also that the value in cell C4, which supplies the *life* argument to the SYD, DB, and DDB functions, matches the year units used in this cell range.

Excel's Advanced Financial Functions

The financial functions discussed so far in this chapter are the ones you use for most of your money-related worksheet models. However, Excel is loaded with tons of more advanced financial functions that can perform some powerful and useful tasks. Table 4-1 lists Excel's advanced financial functions which, as you can see from this table, are varied and quite sophisticated.

You may note in Table 4-1 that many of these financial functions include an optional *basis* argument. The *basis* argument is a number between 0 and 4 that determines the day count basis to use in determining the fractional part of the year:

- 0 (or omitted): Bases the fraction on the U.S. (NASD) method of 30/360 (see the coverage on the DAYS360 function in Book 3, Chapter 3 for details on the U.S. method)
- 1: Bases the fraction on actual days/actual days
- 2: Bases the fraction on actual days/360
- 3: Bases the fraction on actual days/365
- 4: Bases the fraction on the European method of 30/360 (see the DAYS360 coverage in Book 3, Chapter 3 for details on the European method)

REMEMBER For detailed information on the other required arguments for the advanced financial functions shown in this table, select the function from the Financial button's drop-down list and then click the Help on This Function link in the lower-left corner of its Function Arguments dialog box.

TABLE 4-1 Excel's Advanced Financial Functions

Function	*What It Calculates*
ACCRINT(*issue*, *first_interest*, *settlement*, *rate*, *par*, *frequency*, [*basis*], [*calc_method*])	The accrued interest for a security that pays periodic interest.
ACCRINTM(*issue*, *settlement*, *rate*, *par*, [*basis*])	The accrued interest for a security that pays interest at maturity.
AMORDEGRC(*cost*, *date_purchased*, *first_period*, *salvage*, *period*, *rate*, [*basis*]) and AMORLINC(*cost*, *date_purchased*, *first_period*, *salvage*, *period*, *rate*, [*basis*])	Used in French accounting systems for calculating depreciation. AMORDEGRC and AMORLINC return the depreciation for each accounting period. AMORDEGRC works like AMORLINC except that it applies a depreciation coefficient in the calculation that depends upon the life of the assets.
COUPDAYBS(*settlement*, *maturity*, *frequency*, [*basis*])	The number of days from the beginning of a coupon period to the settlement date.
COUPDAYS(*settlement*, *maturity*, *frequency*, [*basis*])	The number of days in the coupon period.
COUPDAYSNC(*settlement*, *maturity*, *frequency*, [*basis*])	The number of days from the settlement date to the next coupon date.
COUPNCD(*settlement*, *maturity*, *frequency*, [*basis*])	A number that represents the next coupon date after a settlement date.
COUPNUM(*settlement*, *maturity*, *frequency*, [*basis*])	The number of coupons payable between the settlement date and maturity date, rounded up to the nearest whole coupon.
COUPPCD(*settlement*, *maturity*, *frequency*, [*basis*])	A number that represents the previous coupon date before the settlement date.
CUMIPMT(*rate*, *nper*, *pv*, *start_period*, *end_period*, *type*)	The cumulative interest paid on a loan between the start_period and end_period. The type argument is 0 when the payment is made at the end of the period and 1 when it's made at the beginning of the period.

CUMPRINC(*rate*, *nper*, *pv*, *start_period*, *end_period*, *type*)	The cumulative principal paid on a loan between the start_period and end_period. The type argument is 0 when the payment is made at the end of the period and 1 when it's made at the beginning of the period.
DISC(*settlement*, *maturity*, *pr*, *redemption*, [*basis*])	The discount rate for a security.
DOLLARDE(*fractional_dollar*, *fraction*)	Converts a dollar price expressed as a fraction into a dollar price expressed as a decimal number.
DOLLARFR(*decimal_dollar*, *fraction*)	Converts a dollar price expressed as a decimal number into a dollar price expressed as a fraction.
DURATION(*settlement*, *maturity*, *coupon*, *yld*, *frequency*, [*basis*])	The Macauley duration for an assumed par value of $100. (*Duration* is defined as the weighted average of the present value of the cash flows and is used as a measure of the response of a bond price to changes in yield.)
EFFECT(*nominal_rate*, *npery*)	The effective annual interest rate given the nominal interest rate and the number of compounding periods per year.
FVSCHEDULE(*principal*, *schedule*)	The future value of an initial deposit after applying a series of compound interest rates.
INTRATE(*settlement*, *maturity*, *investment*, *redemption*, [*basis*])	The interest rate for a fully invested security.
IPMT(*rate*, *per*, *nper*, *pv*, [*fv*], [*type*])	The interest payment for the specified period of a loan or investment.
IRR(*values*, [*guess*])	The internal rate of return for a schedule of cash flows.
ISPMT(*rate*, *per*, *nper*, *pv*)	The interest paid during the specified period of an investment.
MDURATION(*settlement*, *maturity*, *coupon*, *yld*, *frequency*, [*basis*])	The modified Macauley duration for a security with an assumed part value of $100.
MIRR(*values*, *finance_rate*, *reinvest_rate*)	The internal rate of return for a schedule of periodic cash flows factoring in the cost of investment and the interest on the reinvestment of the cash.
NOMINAL(*effect_rate*, *npery*)	The nominal annual interest rate given the effective rate and the number of compounding periods per year.
ODDFPRICE(*settlement*, *maturity*, *issue*, *first_coupon*, *rate*, *yld*, *redemption*, *frequency*, [*basis*])	The price per $100 face value of a security having an odd (short or long) first period.
ODDFYIELD(*settlement*, *maturity*, *issue*, *first_coupon*, *rate*, *pr*, *redemption*, *frequency*, [*basis*])	The yield of a security that has an odd (short or long) first period.
ODDLPRICE(*settlement*, *maturity*, *last_interest*, *rate*, *yld*, *redemption*, *frequency*, [*basis*])	The price per $100 face value of a security having an odd (short or long) last coupon period.
ODDLYIELD(*settlement*, *maturity*, *last_interest*, *rate*, *pr*, *redemption*, *frequency*, [*basis*])	The yield of a security that has an odd (short or long) last period.
PDURATION(*rate*, *pv*, *fv*)	The number of periods that an investment requires to reach the specified future value.
PRICE(*settlement*, *maturity*, *rate*, *yld*, *redemption*, *frequency*, [*basis*])	The price per $100 face value of a security that pays periodic interest.
PRICEDISC(*settlement*, *maturity*, *discount*, *redemption*, [*basis*])	The price per $100 face value of a discounted security.
PRICEMAT(*settlement*, *maturity*, *issue*, *rate*, *yld*, [*basis*])	The price per $100 face value of a security that pays interest at maturity.
RECEIVED(*settlement*, *maturity*, *investment*, *discount*, [*basis*])	The amount received at maturity for a fully invested security.
RRI(*nper*, *pv*, *fv*)	The equivalent interest rate for the growth of an investment.
STOCKHISTORY(*stock*, *start_date*, [*end_date*], [*interval*], [*headers*], [*property0*], ...)	An array of historical stock quote data for the specified stock over the specified date range.)
TBILLEQ(*settlement*, *maturity*, *discount*)	The bond-equivalent yield for a treasury bill.
TBILLPRICE(*settlement*, *maturity*, *discount*)	The price per $100 face value for a treasury bill.
TBILLYIELD(*settlement*, *maturity*, *pr*)	The yield for a treasury bill.
VDB(*cost*, *salvage*, *life*, *start_period*, *end_period*, [*factor*], [*no_switch*])	The deprecation of an asset for a specified period.
XIRR(*values*, *dates*, [*guess*])	The internal rate of return for a schedule of cash flows that are not periodic.
XNPV(*rate*, *values*, *dates*)	The net present value for a schedule of cash flows that are not periodic.
YIELD(*settlement*, *maturity*, *rate*, *pr*, *redemption*, *frequency*, [*basis*])	The yield on a security that pays periodic interest (used to calculate bond yield).
YIELDDISC(*settlement*, *maturity*, *pr*, *redemption*, [*basis*])	Calculates the annual yield for a discounted security.
YIELDMAT(*settlement*, *maturity*, *issue*, *rate*, *pr*, [*basis*])	Calculates the annual yield of a security that pays interest at maturity.

Chapter 5

Math and Statistical Formulas

IN THIS CHAPTER

- **Rounding off numbers**
- **Raising numbers to powers and finding square roots**
- **Conditional summing**
- **Using basic statistical functions, such as AVERAGE, MIN, and MAX**
- **Building formulas that count**
- **Using specialized statistical functions**

This chapter examines two larger categories of Excel functions: Math & Trig and Statistical functions. The Math & Trig functions include all the specialized trigonometric functions such as those that return the sine, cosine, or tangents of various angles and logarithmic functions (for finding the base-10 and natural logarithms of a number), along with the more common math functions for summing numbers, rounding numbers up or down, raising a number to a certain power, and finding the square root of numbers.

The Statistical functions include the more common functions that return the average, highest, and lowest values in a cell range all the way to the very sophisticated and specialized functions that calculate such things as the chi-squared distribution, binomial distribution probability, frequency, standard deviation, variance, and the skewness (great word!) of a distribution in a particular population.

Math & Trig Functions

You can access the Math & Trig functions either via the Insert Function icon on the Formula bar, or via the Ribbon's Formulas tab by clicking the Math & Trig drop-down menu.

The Math & Trig category groups together all the trigonometric functions with the more common arithmetic functions. Although the trigonometric functions are primarily of use to engineers and scientists, the mathematical functions provide you with the ability to manipulate any type of value. The math functions include SUM, the most commonly used of all functions; functions such as INT, EVEN, ODD, and ROUND, that rounds off the values in your worksheet; functions such as PRODUCT, SUMPRODUCT, and SUMSQ that you can use to calculate the products of various values in the worksheet; and the SQRT function that you can use to calculate the square root of a value.

Rounding off numbers

You use the ROUND function to round up or down fractional values in the worksheet as you might when working with financial worksheets that need to show monetary values only to the nearest dollar. Unlike when applying a number format to a cell, which affects only the number's display, the ROUND function actually changes the way Excel stores the number in the cell that contains the function. ROUND uses the following syntax:

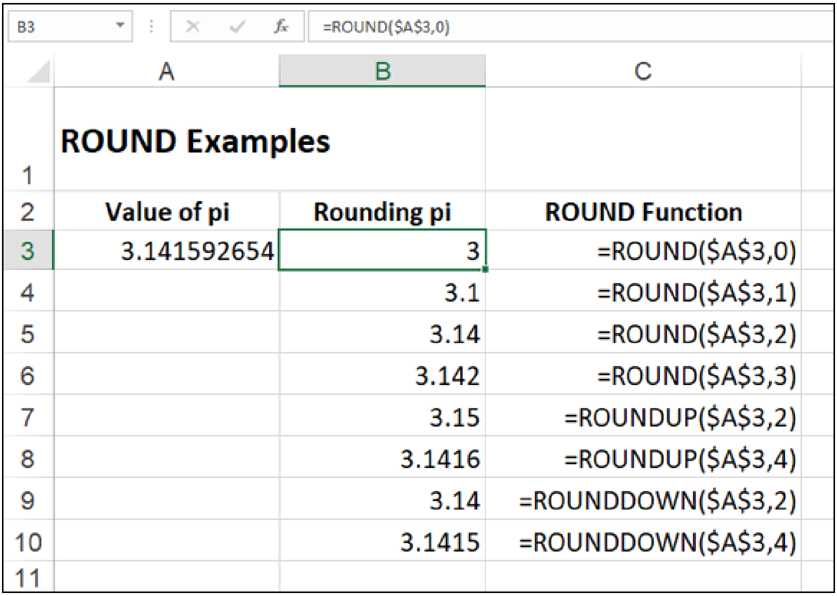
```
ROUND(number, num:digits)
```

In this function, the *number* argument is the value that you want to round off, and *num:digits* is the number of digits to which you want the number rounded. If you enter 0 (zero) as the *num:digits* argument, Excel rounds the number to the nearest integer. If you make the *num:digits* argument a positive value, Excel rounds the number to the specified number of decimal places. If you enter the *num:digits* argument as a negative number, Excel rounds the number to the left of the decimal point.

Instead of the ROUND function, you can use the ROUNDUP or ROUNDDOWN function. Both ROUNDUP and ROUNDDOWN take the same *number* and *num:digits* arguments as the ROUND function. The difference is that the ROUNDUP function always rounds up the value specified by the number argument, whereas the ROUNDDOWN function always rounds the value down.

Figure 5-1 (sample workbook: Round Function Examples.xlsx) illustrates the use of the ROUND, ROUNDUP, and ROUNDDOWN functions in rounding off the value of the mathematical constant pi (π). In cell A3, I entered the value of this constant (with just nine places of nonrepeating fraction displayed when the column is widened) into this cell, using Excel's PI function in the following formula:

```
=PI()
```



	A	B	C
1	**ROUND Examples**		
2	**Value of pi**	**Rounding pi**	**ROUND Function**
3	3.141592654	3	=ROUND($A$3,0)
4		3.1	=ROUND($A$3,1)
5		3.14	=ROUND($A$3,2)
6		3.142	=ROUND($A$3,3)
7		3.15	=ROUNDUP($A$3,2)
8		3.1416	=ROUNDUP($A$3,4)
9		3.14	=ROUNDDOWN($A$3,2)
10		3.1415	=ROUNDDOWN($A$3,4)
11			

FIGURE 5-1: Rounding off the value of pi with the ROUND, ROUNDUP, and ROUNDDOWN functions. (Sample workbook: Round Function Examples.xlsx)

I then used the ROUND, ROUNDUP, and ROUNDDOWN functions in the cell range B3 through B10 to round this number up and down to various decimal places.

Cell B3, the first cell that uses one of the ROUND functions to round off the value of pi, rounds this value to 3 because I used 0 (zero) as the *num:digits* argument of its ROUND function (causing Excel to round the value to the nearest whole number).

In Figure 5-1, note the difference between using the ROUND and ROUNDUP functions both with 2 as their *num:digits* arguments in cells B5 and B7, respectively. In cell B5, Excel rounds the value of pi off to 3.14, whereas in cell B7, the program rounds its value up to 3.15. Note that using the ROUNDDOWN function with 2 as its *num:digits* argument yields the same result, 3.14, as does using the ROUND function with 2 as its second argument.

The whole number and nothing but the whole number

You can also use the INT (for Integer) and TRUNC (for Truncate) functions to lop off unneeded parts of values in your worksheets. You use these functions only when you don't care about all or part of the fractional portion of the value.

When you use the INT function, which requires only a single *number* argument, Excel rounds the value down to the nearest integer (whole number). For example, cell A3 contains the value of pi, as shown in Figure 5-1, and you enter the following INT function formula in the worksheet:

```
=INT(A3)
```

Excel returns the value 3 to the cell, the same as when you use 0 (zero) as the *num:digits* argument of the ROUND function in cell B3.

The TRUNC function uses the same number and *num:digits* arguments as the ROUND, ROUNDUP, and ROUNDDOWN functions, except that in the TRUNC function, the *num:digits* argument is purely optional. This argument is required in the ROUND, ROUNDUP, and ROUNDDOWN functions.

The TRUNC function doesn't round off the number in question; it truncates the number to the nearest integer by removing the fractional part of the number. However, if you specify a *num:digits* argument, Excel uses that value to determine the precision of the truncation. So, going back to the example illustrated in Figure 5-1, if you enter the following TRUNC function, omitting the optional *num:digits* argument as in

```
=TRUNC($A$3)
```

Excel returns 3 to the cell just like the formula =ROUND($A$3,0) does in cell B3. However, if you modify this TRUNC function by using 2 as its *num:digits* argument, as in

```
=TRUNC($A$3,2)
```

Excel then returns 3.14 (by cutting the rest of the fraction) just as the formula =ROUND($A$3,2) does in cell B5.

The only time you notice a difference between the INT and TRUNC functions is when you use them with negative numbers or when you use a negative value for the TRUNC function's *num:digits* argument. For example, if you use the TRUNC function to truncate the value –5.4 in the following formula:

```
=TRUNC(-5.4)
```

Excel returns –5 to the cell. If, however, you use the INT function with the same negative value, as in

```
=INT(-5.4)
```

Excel returns –6 to the cell. This is because the INT function rounds numbers down to the nearest integer using the fractional part of the number.

Similarly, if you use INT with the value 12345.678, as in the following formula:

```
=INT(12345.678)
```

Excel returns 12345. However, if you use TRUNC on the same value, but with -2 as the *num:digits* argument, as in the formula:

```
=TRUNC(12345.678, -2)
```

Excel returns 12300. In this case, TRUNC “truncates” the first two digits to the left of the decimal point by converting them to 0s.

Let’s call it even or odd

Excel’s EVEN and ODD functions also round off numbers. The EVEN function rounds the value specified as its *number* argument up to the nearest even integer. The ODD function, of course, does just the opposite: rounding the value up to the nearest odd integer. So, for example, if cell C18 in a worksheet contains the value 345.25 and you use the EVEN function in the following formula:

```
=EVEN(C18)
```

Excel rounds the value up to the next whole even number and returns 346 to the cell. If, however, you use the ODD function on this cell, as in

```
=ODD(C18)
```

Excel rounds the value up to the next odd whole number and returns 347 to the cell instead.

Building in a ceiling

The CEILING.MATH function enables you to not only round up a number, but also set the multiple of significance to be used when doing the rounding. This function can be very useful when dealing with figures that need rounding to particular units.

For example, suppose that you're building a worksheet that lists the retail prices for the products that you sell, all based upon a particular markup over wholesale, and that many of these calculations result in prices with cents below 50. If you don't want to have any prices in the list that aren't rounded to the nearest 50 cents or whole dollar, you can use the CEILING function to round up all these calculated retail prices to the nearest half dollar.

The CEILING.MATH function uses the following syntax:

```
CEILING.MATH(number, [significance], [mode])
```

The *number* argument specifies the number you want to round up and the optional *significance* argument specifies the multiple to which you want to round. (By default, the significance is +1 for positive numbers and –1 for negative numbers.) The optional *mode* argument comes into play only when dealing with negative numbers where the mode value indicates the direction toward (+1) or away (–1) from 0.

For the half-dollar example, suppose that you have the calculated number $12.35 in cell B3 and you enter the following formula in cell C3:

```
=CEILING.MATH(B3, 0.5)
```

Excel then returns $12.50 to cell C3. Further, suppose that cell B4 contains the calculated value $13.67, and you copy this formula down to cell C4 so that it contains

```
=CEILING.MATH(B4, 0.5)
```

Excel then returns $14.00 to that cell.

REMEMBER CEILING.MATH replaces the CEILING function supported in older versions of Excel (prior to Excel 2019). You can still use the CEILING function to round your values; just be aware that this function is no longer available on the Math & Trig drop-down menu on the FORMULAS tab of the Ribbon or in the Insert Function dialog box. To use CEILING, either choose Formulas ⇒ More Functions ⇒ Compatibility ⇒ CEILING, or type =**cei** directly into the cell to have the CEILING function appear in the function drop-down menu immediately below CEILING.MATH.

POWER and SQRT

Although you can use the caret (^) operator to build a formula that raises a number to any power, you also need to be aware that Excel includes a math function called POWER that accomplishes the same thing. For example, to build a formula that raises 5.9 to the third power (that is, cubes the number), you can use the exponentiation operator, as in

```
=5.9 ^ 3
```

You can have Excel perform the same calculation with the POWER function by entering this formula:

```
=POWER(5.9, 3)
```

In either case, Excel returns the same result, 205.379. The only difference between using the exponentiation operator and the POWER function occurs on that rare, rare occasion when you have to raise a number by a fractional power. In that case, you need to use the POWER function instead of the caret (^) operator to get the correct result. For example, suppose that you need to raise 20 by the fraction 3/4; to do this, you build the following formula with the POWER function:

```
=POWER(20, 3/4)
```

To use the exponentiation operator to calculate the result of raising 20 by the fraction 3/4, you can convert the fraction into decimal form, as in

```
=20 ^ 0.75
```

The SQRT function calculates the square root of any number that you specify as its sole *number* argument. For example, if you use the SQRT function to build the following formula in a cell:

```
=SQRT(144)
```

Excel returns 12 to that cell.

WARNING The SQRT function can’t deal with negative numbers, so if you try to find the square root of a negative value, Excel returns a nice #NUM! error value to that cell. To avoid such a nuisance, you need to use the ABS (for absolute) math function, which returns the absolute value of a number (that is, the number without a sign). For example, suppose that cell A15 contains `($49.00)`, a negative value formatted in parentheses with the Accounting Number format to show that it's something you owe, and you want to return the square root of this number in cell A16. To avoid the dreaded #NUM! error, you nest the ABS function inside the SQRT function. The ABS function returns the absolute value of the number you specify as its sole argument (that is, the value without its sign). To nest this function inside the SQRT function, you create the following formula:

```
=SQRT(ABS(A15))
```

Excel then returns 7 instead of #NUM! to cell A16 because the ABS function removes the negative sign from the 49.00 before the SQRT function calculates its square root. (Remember that Excel always performs the calculations in the innermost pair of parentheses first.)

The SUM of the parts

No function in the entire galaxy of Excel functions comes anywhere close to the popularity of the SUM function in the worksheets that you build. So popular is this function, in fact, that Excel has its own Alt+= shortcut key as well as a Sum command button located on the Home tab and on the Formula tab of the Ribbon (the one with the Σ on it) that you most often use to build your SUM formulas. You should, however, be aware of the workings of the basic SUM function that the AutoSum button enables you to use so easily.

For the record, the syntax of the SUM function is as follows:

```
SUM(number1, [number2], […])
```

When using the SUM function, only the *number1* argument is required; this is the range of numbers in a cell range or array constant that you want added together. Be aware that you can enter up to a total of 29 other optional *number* arguments in a single SUM formula. For example, you can build a SUM formula that totals numbers in several different ranges, as in

```
=SUM(B3:B10, Sheet2!B3:B10, Sheet3!B3:B10)
```

In this example, Excel sums the values in the cell range B3:B10 on

Sheet1, Sheet2, and Sheet3 of the workbook, giving you the grand total of all these values in whatever cell you build this SUM formula.

Conditional summing

The SUM function is perfect when you want to get the totals for all the numbers in a particular range or set of ranges. But what about those times when you only want the total of certain items within a cell range? For those situations, you can use the SUMIF or SUMIFS function.

The SUMIF function enables you to tell Excel to add together the numbers in a particular range *only* when those numbers meet the criteria that you specify. The syntax of the SUMIF function is as follows:

```
SUMIF(range, criteria, [sum:range])
```

In the SUMIF function, the *range* argument specifies the range of cells that you want Excel to evaluate when doing the summing; the *criteria* argument specifies the criteria to be used in evaluating whether to include certain values in the range in the summing; and finally, the optional *sum:range* argument is the range of all the cells to be summed. If you omit the *sum:range* argument, Excel sums the cells specified in the *range* argument if they meet the criteria specified in the *criteria* argument.

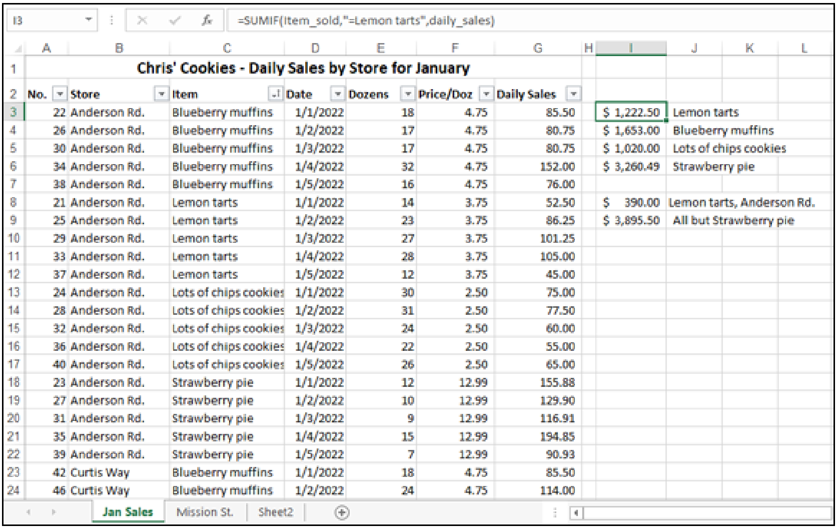
The SUMIFS function works like SUMIF function except that it enables you to specify more than one criteria range that controls when a certain range of values are summed. Its syntax is a little bit different:

```
SUMIFS(sum:range, criteria_range, criteria, …)
```

For this function, the *sum:range* argument specifies all the possible values that can be summed, the *criteria_range* specifies the cells with all the entries that are to be evaluated by the if criteria, and the *criteria* argument contains the expression that is to be applied to the entries in the *criteria_range* to determine which of the values to total in the *sum:range.*

Summing certain cells with SUMIF

Figure 5-2 (sample workbook: Chris Cookies - January Sales.xlsx) illustrates how you can use the SUMIF function to total sales by the items sold. This figure shows a Sales data list sorted by the store location and then the item sold. In this Daily Sales data list, there are three locations: Mission Street, Anderson Rd., and Curtis Way, of which only sales made at the Anderson Rd. location are visible in this figure.



=SUMIF(Item_sold,"=Lemon tarts",daily_sales)

	A	B	C	D	E	F	G	H	I	J	K	L
1	Chris' Cookies - Daily Sales by Store for January											
2	No.	Store	Item	Date	Dozens	Price/Doz	Daily Sales					
3	22	Anderson Rd.	Blueberry muffins	1/1/2022	18	4.75	85.50		$ 1,222.50	Lemon tarts		
4	26	Anderson Rd.	Blueberry muffins	1/2/2022	17	4.75	80.75		$ 1,653.00	Blueberry muffins		
5	30	Anderson Rd.	Blueberry muffins	1/3/2022	17	4.75	80.75		$ 1,020.00	Lots of chips cookies		
6	34	Anderson Rd.	Blueberry muffins	1/4/2022	32	4.75	152.00		$ 3,260.49	Strawberry pie		
7	38	Anderson Rd.	Blueberry muffins	1/5/2022	16	4.75	76.00					
8	21	Anderson Rd.	Lemon tarts	1/1/2022	14	3.75	52.50		$ 390.00	Lemon tarts, Anderson Rd.		
9	25	Anderson Rd.	Lemon tarts	1/2/2022	23	3.75	86.25		$ 3,895.50	All but Strawberry pie		
10	29	Anderson Rd.	Lemon tarts	1/3/2022	27	3.75	101.25					
11	33	Anderson Rd.	Lemon tarts	1/4/2022	28	3.75	105.00					
12	37	Anderson Rd.	Lemon tarts	1/5/2022	12	3.75	45.00					
13	24	Anderson Rd.	Lots of chips cookies	1/1/2022	30	2.50	75.00					
14	28	Anderson Rd.	Lots of chips cookies	1/2/2022	31	2.50	77.50					
15	32	Anderson Rd.	Lots of chips cookies	1/3/2022	24	2.50	60.00					
16	36	Anderson Rd.	Lots of chips cookies	1/4/2022	22	2.50	55.00					
17	40	Anderson Rd.	Lots of chips cookies	1/5/2022	26	2.50	65.00					
18	23	Anderson Rd.	Strawberry pie	1/1/2022	12	12.99	155.88					
19	27	Anderson Rd.	Strawberry pie	1/2/2022	10	12.99	129.90					
20	31	Anderson Rd.	Strawberry pie	1/3/2022	9	12.99	116.91					
21	35	Anderson Rd.	Strawberry pie	1/4/2022	15	12.99	194.85					
22	39	Anderson Rd.	Strawberry pie	1/5/2022	7	12.99	90.93					
23	42	Curtis Way	Blueberry muffins	1/1/2022	18	4.75	85.50					
24	46	Curtis Way	Blueberry muffins	1/2/2022	24	4.75	114.00					

FIGURE 5-2: Using SUMIF to total sales by items sold. (Sample workbook: Chris Cookies - January Sales.xlsx)

To total the sales of Lemon tarts at all three locations in this data list, I created the following SUMIF formula in cell I3:

```
=SUMIF(item:sold, "=Lemon tarts", daily_sales)
```

In this example, item:sold is the range name given to the cell range C3:C62, which contains the list of each item that has been sold in the first five days of January, 2022 (Lemon tarts, Blueberry muffins, Lots of chips cookies, or Strawberry pie), and daily_sales is the range name assigned to the cell range G3:G62, which contains the extended sales made at each store for each item.

The SUMIF formula in cell I3 then looks for each occurrence of “Lemon tarts” in the item:sold range (the *criteria* argument for the SUMIF function) in the Item column of the Cookie Sales list and then adds its extended sales price from the daily_sales range in the Daily Sales column to the total.

The formulas in cells I4, I5, and I6 contain SUMIF functions very similar to the one in cell I3, except that they substitute the name of the dessert goodie in question in place of the =Lemon tarts *criteria* argument.

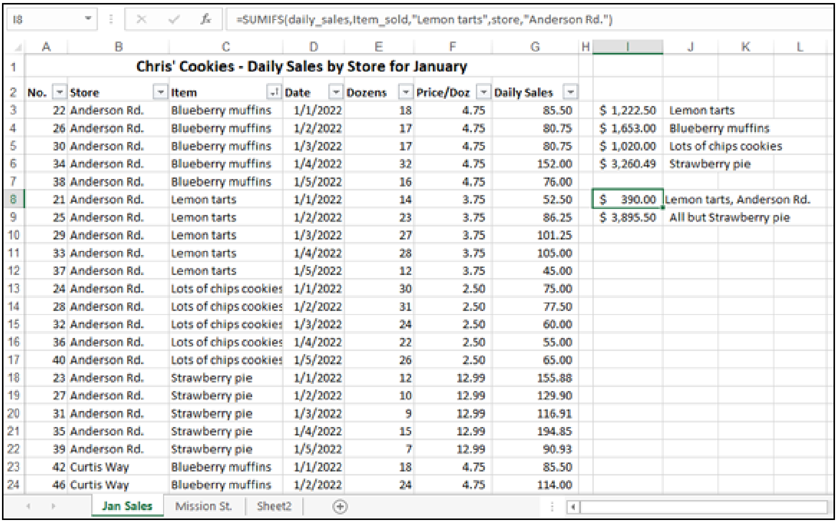
Summing on multiple criteria with SUMIFS

Figure 5-3 (sample workbook: Chris Cookies - January Sales.xlsx) illustrates the use of the SUMIFS function to apply multiple criteria in the summing of the daily sales. Here, I want to know the total of the sales of one item (Lemon tarts) at one store location (Anderson Rd.).

To do this, I created the following formula in cell I8, using the SUMIFS function:

```
=SUMIFS(daily_sales, item:sold, "Lemon tarts", store,
"Anderson Rd.")
```

In this formula, the *sum:range* argument (specified first and not last as in SUMIF) is still the daily_sales cell range (G3:G62). The first *criteria_range* argument is item:sold (C3:C62) where the criteria is "Lemon tarts," and the second *criteria_range* argument is store (B3:B62) where the criteria is "Anderson Rd." When Excel evaluates the formula in cell I8, it applies both criteria so that the program ends up totaling only those daily sales where the item is Lemon tarts and the store location is Anderson Rd.



=SUMIFS(daily_sales,Item_sold,"Lemon tarts",store,"Anderson Rd.")

Chris' Cookies - Daily Sales by Store for January

No.	Store	Item	Date	Dozens	Price/Doz	Daily Sales	I	J
22	Anderson Rd.	Blueberry muffins	1/1/2022	18	4.75	85.50	$ 1,222.50	Lemon tarts
26	Anderson Rd.	Blueberry muffins	1/2/2022	17	4.75	80.75	$ 1,653.00	Blueberry muffins
30	Anderson Rd.	Blueberry muffins	1/3/2022	17	4.75	80.75	$ 1,020.00	Lots of chips cookies
34	Anderson Rd.	Blueberry muffins	1/4/2022	32	4.75	152.00	$ 3,260.49	Strawberry pie
38	Anderson Rd.	Blueberry muffins	1/5/2022	16	4.75	76.00		
21	Anderson Rd.	Lemon tarts	1/1/2022	14	3.75	52.50	$ 390.00	Lemon tarts, Anderson Rd.
25	Anderson Rd.	Lemon tarts	1/2/2022	23	3.75	86.25	$ 3,895.50	All but Strawberry pie
29	Anderson Rd.	Lemon tarts	1/3/2022	27	3.75	101.25		
33	Anderson Rd.	Lemon tarts	1/4/2022	28	3.75	105.00		
37	Anderson Rd.	Lemon tarts	1/5/2022	12	3.75	45.00		
24	Anderson Rd.	Lots of chips cookies	1/1/2022	30	2.50	75.00		
28	Anderson Rd.	Lots of chips cookies	1/2/2022	31	2.50	77.50		
32	Anderson Rd.	Lots of chips cookies	1/3/2022	24	2.50	60.00		
36	Anderson Rd.	Lots of chips cookies	1/4/2022	22	2.50	55.00		
40	Anderson Rd.	Lots of chips cookies	1/5/2022	26	2.50	65.00		
23	Anderson Rd.	Strawberry pie	1/1/2022	12	12.99	155.88		
27	Anderson Rd.	Strawberry pie	1/2/2022	10	12.99	129.90		
31	Anderson Rd.	Strawberry pie	1/3/2022	9	12.99	116.91		
35	Anderson Rd.	Strawberry pie	1/4/2022	15	12.99	194.85		
39	Anderson Rd.	Strawberry pie	1/5/2022	7	12.99	90.93		
42	Curtis Way	Blueberry muffins	1/1/2022	18	4.75	85.50		
46	Curtis Way	Blueberry muffins	1/2/2022	24	4.75	114.00		

FIGURE 5-3: Using SUMIFS to total sales by location as well as the items sold. (Sample workbook: Chris Cookies - January Sales.xlsx)

The formula in cell I9 immediately below in the worksheet shown in Figure 5-3 also uses the SUMIFS function, but this time applies just a single criteria in performing the summation. This formula sums the daily sales for any bakery item that is not a Strawberry pie:

```
=SUMIFS(daily_sales, item:sold, "<>Strawberry pie")
```

Because I prefaced the item Strawberry pie with the not (< >) operator (which can be placed before or after the open double quotation mark), Excel sums the sale of every item except for Strawberry pie.

Statistical Functions

Excel includes one of the most complete sets of statistical functions available outside of a dedicated statistics software program. When you want to access these functions from the Ribbon's Formulas tab instead of using the Insert Function dialog box, you need to click the More Functions command button and then click Statistical in the drop-down menu (or press Alt + MQS).

The statistical functions run the gamut from the more mundane AVERAGE, MAX, and MIN functions to the more exotic and much more specialized CHITEST, POISSON, and PERCENTILE statistical functions.

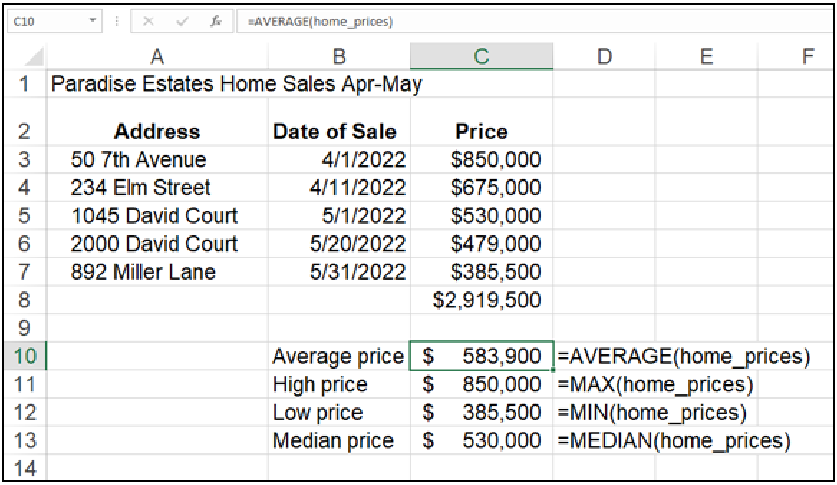
In addition to the more specialized statistical functions, Excel offers an assortment of counting functions that enable you to count the number of cells that contain values, count the number that are nonblank (and thus contain entries of any kind), or count the cells in a given range that meet the criteria that you specify.

AVERAGE, MAX, MIN, and MEDIAN

The AVERAGE, MAX (for maximum), MIN (for minimum), and MEDIAN functions are the most commonly employed of the statistical functions because they are of use to both the average number cruncher as well as the dedicated statistician. All three functions follow the same syntax as the good old SUM function. For example, the syntax of the AVERAGE function uses the following arguments just as the SUM, MAX, and MIN functions do:

```
AVERAGE(number1, [number2], […])
```

Just as in the SUM function, the *number* arguments are between 1 and 30 numeric arguments for which you want the average. Figure 5-4 (sample workbook: Paradise Estates - Apr-May Sales.xlsx) illustrates how you can use the AVERAGE, MAX, MIN, and MEDIAN functions in a worksheet. This example uses these functions to compute a few statistics on the selling prices of homes in a particular neighborhood. These statistics include the average, highest, lowest, and median selling price for the homes sold in April and May. All the statistical functions in this worksheet use the same *number* argument; that is, the cell range named home_prices in C3:C7.



C10 =AVERAGE(home_prices)

	A	B	C	D	E	F
1	Paradise Estates Home Sales Apr-May					
2	**Address**	**Date of Sale**	**Price**			
3	50 7th Avenue	4/1/2022	$850,000			
4	234 Elm Street	4/11/2022	$675,000			
5	1045 David Court	5/1/2022	$530,000			
6	2000 David Court	5/20/2022	$479,000			
7	892 Miller Lane	5/31/2022	$385,500			
8			$2,919,500			
9						
10		Average price	$ 583,900	=AVERAGE(home_prices)		
11		High price	$ 850,000	=MAX(home_prices)		
12		Low price	$ 385,500	=MIN(home_prices)		
13		Median price	$ 530,000	=MEDIAN(home_prices)		
14						

FIGURE 5-4: Home sales worksheet using common statistical functions. (Sample workbook: Paradise Estates - Apr-May Sales.xlsx)

The AVERAGE function computes the arithmetic mean of the values in this range by summing them and then dividing them by the number of values in the range.

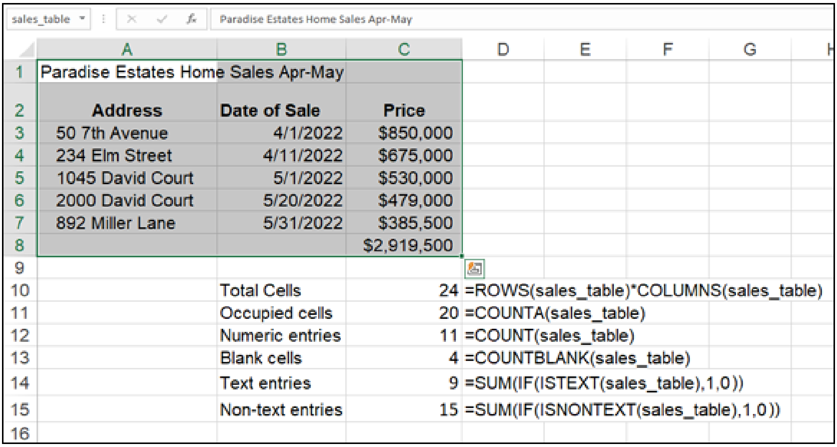
The MAX and MIN functions compute the highest and lowest values in the cell range used as the *number* argument. The MEDIAN function computes the value that is in the middle of the range of values; that is, the one where half the values are greater and half are less. This is the reason that the median sales price (in cell C13) differs from the average sales price (in cell C10) in this worksheet.

Counting cells

Sometimes you need to know how many cells in a particular cell range, column or row, or even worksheet in your workbook have cell entries and how many are still blank. Other times, you need to know just how many of the occupied cells have text entries and how many have numeric entries. Excel includes a number of counting functions that you can use in building formulas that calculate the number of cells in a particular region or worksheet that are occupied and can tell you what general type of entry they contain.

Building counting formulas

Figure 5-5 (sample workbook: Paradise Estates - Apr-May Sales Count.xlsx) illustrates the different types of counting formulas that you can build to return such basic statistics as the total number of cells in a particular range, the number of occupied cells in that range, as well as the number of numeric and text entries in the occupied range. In this example worksheet, I gave the name sales_table to the cell range A1:C8 (shown selected in Figure 5-5).



sales_table

Paradise Estates Home Sales Apr-May

	A	B	C	D	E	F	G
1	Paradise Estates Home Sales Apr-May						
2	Address	Date of Sale	Price				
3	50 7th Avenue	4/1/2022	$850,000				
4	234 Elm Street	4/11/2022	$675,000				
5	1045 David Court	5/1/2022	$530,000				
6	2000 David Court	5/20/2022	$479,000				
7	892 Miller Lane	5/31/2022	$385,500				
8			$2,919,500				
9							
10		Total Cells	24	=ROWS(sales_table)*COLUMNS(sales_table)			
11		Occupied cells	20	=COUNTA(sales_table)			
12		Numeric entries	11	=COUNT(sales_table)			
13		Blank cells	4	=COUNTBLANK(sales_table)			
14		Text entries	9	=SUM(IF(ISTEXT(sales_table),1,0))			
15		Non-text entries	15	=SUM(IF(ISNONTEXT(sales_table),1,0))			
16							

FIGURE 5-5: A version of the home sales worksheet with various counting formulas. (Sample workbook: Paradise Estates - Apr-May Sales Count.xlsx)

I then used the sales_table range name in a number of formulas that count its different aspects. The most basic formula is the one that returns the total number of cells in the sales_table range. To build this formula in cell C10, I used the ROWS and COLUMNS information functions (see Book 3, Chapter 6 for more on these types of functions) to return the number of rows and columns in the range, and then I created the following formula that multiplies these two values together:

```
=ROWS(sales_table) * COLUMNS(sales_table)
```

This formula, of course, returns 24 to cell C10. In the next formula, I calculated the number of these 24 cells that contain data entries (of whatever type) using the COUNTA function. This function counts the number of cells that are not empty in the ranges that you specify. The COUNTA function uses the following syntax:

COUNTA(*value1*, [*value2*], […])

The *value* arguments (all of which are optional except for value1) are up to 30 different values or cell ranges that you want counted. Note that the COUNTA function counts a cell as long it has some entry, even if the entry is empty text set off by a single apostrophe ('). In the example shown in Figure 5-5, cell C11 contains the following COUNTA function:

```
=COUNTA(sales_table)
```

This formula returns 20 to cell C11. The next formula in the sample worksheet calculates the number of numeric entries in the cell range called sales_table. To do this, you use the COUNT function. The COUNT function takes the same arguments as COUNTA, the only difference being that COUNT counts a value or cell specified in its *value* arguments only if it contains a numeric entry.

Cell C12 contains the following formula for calculating the number of numeric entries in the Home Sales table range called sales_table:

```
=COUNT(sales_table)
```

Excel returns 11 to cell C12. Note that in calculating this result, Excel counts the five date entries (with the date of each sale) in the cell range B3:B7 as well as the six numeric data entries (with the selling prices of each home plus total) in the cell range C3:C8.

The next formula in the sample worksheet shown in Figure 5-5 uses the COUNTBLANK function to calculate the number of blank cells in the sales_table range. The COUNTBLANK function works just like the COUNTA and COUNT functions except that it returns the number of nonoccupied cells in the range. For this example, I entered the following COUNTBLANK function in cell C13:

```
=COUNTBLANK(sales_table)
```

Excel then returns 4 to cell C13 (which makes sense because you know that of the 24 total cells in this range, Excel already said that 20 of them have entries of some kind).

The last two counting formulas in the sample worksheet shown in Figure 5-5 return the number of text and nontext entries in the sales_table cell range. To do this, instead of counting functions, they use the ISTEXT and ISNONTEXT information functions as part of the IF conditions used in conjunction with the good old SUM function.

The first formula for returning the number of text entries in the sales_table range in cell C14 is

```
{=SUM(IF(ISTEXT(sales_table), 1, 0))}
```

The second formula for returning the number of nontext entries in the sales_table range in cell C15 is just like the one in cell C15 except that it uses the ISNONTEXT function instead of ISTEXT, as follows:

```
{=SUM(IF(ISNONTEXT(sales_table), 1, 0))}
```

The ISTEXT function in the formula in cell C14 returns logical TRUE when a cell in the sales_table range contains a text entry and FALSE when it does not. The ISNONTEXT function in the formula in cell C15 returns logical TRUE when a cell is blank or contains a numeric entry (in other words, anything but text) and FALSE when it contains text.

In both these formulas, the ISTEXT and ISNONTEXT functions are used as the *logical_test* arguments of an IF function with 1 as the *value_if_true* argument and 0 as the *value_if_false* argument (so that the cells are counted only when the ISTEXT or ISNONTEXT functions return the logical TRUE values). These IF functions are then nested within SUM functions, and these SUM functions, in turn, are entered as array formulas.

Counting occupied cells in entire rows, columns, and worksheets

You can use the COUNTA function to count the number of occupied cells in an entire row or column of a worksheet or even an entire worksheet in your workbook. For example, to count all the occupied cells in row 17 of a worksheet, you enter the following COUNTA formula:

```
=COUNTA(17:17)
```

If you want to find the number of nonblank cells in column B of the worksheet, you enter the following COUNTA formula:

```
=COUNTA(B:B)
```

To find out the number of occupied cells in the entire second worksheet of your workbook (assuming that it’s still called Sheet2), you enter this COUNTA formula:

```
=COUNTA(Sheet2!1:1048576)
```

Note that you can also enter the argument for this COUNTA function by designating the entire range of column letters (rather than the range of row numbers) as in:

```
=COUNTA(Sheet2!A:XFD)
```

However, Excel automatically converts the argument that specifies the range of columns to rows, using absolute references ($1:$1048576) as soon as you enter the COUNTA function in its cell.

WARNING When entering COUNTA functions that return the number of occupied cells in an entire row, column, or worksheet, you must be sure that you do *not* enter the formula in a cell within that row, column, or worksheet. If you do, Excel displays a Circular Reference Alert dialog box when you try to enter the formula in the worksheet. This happens because you are asking Excel to use the cell with the formula that does the counting in the count itself (definitely the type of circular logic that the program doesn't allow).

Conditional counting

Excel includes a COUNTIF function that you can use to count cells in a range only when they meet a certain condition. The COUNTIF function takes two arguments and uses the following syntax:

```
COUNTIF(range, criteria)
```

The *range* argument specifies the range of cells from which the conditional count is to be calculated. The *criteria* argument specifies the condition to use. You can express this argument as a number, expression, or text that indicates which cells to count. When specifying a number for the *criteria* argument, you don't have to enclose the number in quotes. For example, in a cell range named table_data, to count the number of entries that contain the number 5, you enter the following COUNTIF formula:

```
=COUNTIF(table_data, 5)
```

However, when specifying an expression or text as the *criteria* argument, you must enclose the expression or text in closed quotes as in “=5”, “>20”, or “New York”. So, if you want to use COUNTIF to find out how many cells in the table_data range have values greater than 5, you enter this version of the COUNTIF function:

```
=COUNTIF(table_data, ">5")
```

When you want to use the COUNTIF function to find out the number of cells whose contents are equal to the contents of a particular cell in the worksheet, you just add the cell reference as the function’s *criteria* argument. For example, if you want to count the number of cells in the table_data range that are equal to the contents of cell B3 in the worksheet, you enter this formula:

```
=COUNTIF(table_data, B3)
```

However, when you want to specify an expression other than equality that refers to the contents of a cell in the worksheet, you must enclose the operator in a pair of double quotation marks and then add the ampersand (&) concatenation operator before the cell reference. For example, if you want to count how many cells in the table_data range have a value greater than the contents of cell B3, you enter this form of the COUNTIF function:

```
=COUNTIF(table_data, ">" & B3)
```

Note that when specifying text as the condition, you can use the two wildcard characters: the asterisk (*) to represent an unspecified number of characters and the question mark (?) to represent single characters in the COUNTIF function’s *criteria* argument. For example, to count all the cells in the table_data range whose text entries end with the word *Street,* you use the asterisk in the COUNTIF *criteria* argument as follows:

```
=COUNTIF(table_data, "*Street")
```

To count the cells in the table_data range whose text entries contain the word *discount* anywhere in the entry, you sandwich *discount* between two asterisks in the COUNTIF *criteria* argument as follows:

```
=COUNTIF(table_data, "*discount*")
```

To count the cells in the table_data range whose cell entries consist of any two characters followed by the letter *y* (as in *day, say, pay,* and so on), you use two question marks to stand in for the nonspecific characters followed by a *y* in the COUNTIF *criteria* argument, as in

```
=COUNTIF(table_data, "??y")
```

When using the COUNTIF function to find the number of cells, you can include other statistical functions as the *criteria* argument. For example, suppose that you want to know the number of cells in the table_data range whose values are less than the average value in the range. To do this, you insert the AVERAGE function in the COUNTIF *criteria* argument as follows:

```
=COUNTIF(table_data, "<" & AVERAGE(table_data))
```

Using specialized statistical functions

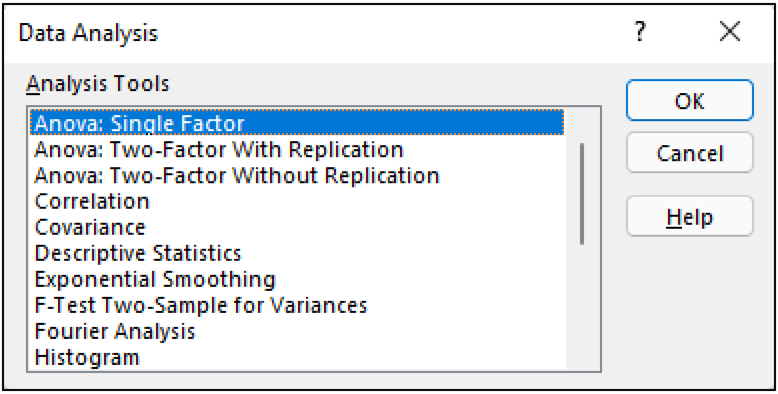
You can use the built-in statistical functions found on the Statistical continuation menu or located in the Statistical category in the Insert Function dialog box, both of which I discuss earlier in this chapter. Excel also offers a complete set of special analysis tools as part of the Analysis ToolPak add-in.

The tools included in the Analysis ToolPak enable you to analyze worksheet data by using such things as ANOVA, F-test, rank and percentile, t-test, and Fourier Analysis.

TIP If you want to dive deep into these and other statistical functions, get yourself a copy of *Statistical Analysis with Excel For Dummies*, 5th Edition by Joseph Schmuller, PhD, which covers the statistical functions in exquisite detail.

To load these tool packs so that you can use their functions, you need to open the Add-Ins dialog box by choosing File ⇒ Options ⇒ Add-Ins and then clicking the Go button at the bottom of the Excel Options dialog box (make sure that Excel Add-ins is displayed in the Manage drop-down list box before you click Go). In the Add-Ins dialog box, select the Analysis ToolPak check box and then click OK.

In the Data tab's Analysis group, click the Data Analysis button (or press Alt+AY2). Excel opens the Data Analysis dialog box, as shown in Figure 5-6.


Data Analysis
?
Analysis Tools
OK
Cancel
Help

Anova: Single Factor
Anova: Two-Factor With Replication
Anova: Two-Factor Without Replication
Correlation
Covariance
Descriptive Statistics
Exponential Smoothing
F-Test Two-Sample for Variances
Fourier Analysis
Histogram

FIGURE 5-6: Selecting a statistical analysis tool added by the Analysis ToolPak.

Chapter 6

Lookup, Information, and Text Formulas

IN THIS CHAPTER

- **Looking up data in a table and adding it to a list**
- **Transposing vertical cell ranges to horizontal and vice versa**
- **Getting information about a cell’s contents**
- **Evaluating a cell’s type with the IS information functions**
- **Using text functions to manipulate text entries**
- **Creating formulas that combine text entries**

This chapter covers three categories of Excel functions: the lookup and reference functions that return values and cell addresses from the worksheet; the information functions that return particular types of information about cells in the worksheet; and the text functions that enable you to manipulate strings of text in the worksheet.

In these three different categories of Excel functions, perhaps none are as handy as the lookup functions that enable you to have Excel look up certain data in a range and then return other related data from that same range based on the parameters of that lookup.

Looking Up Stuff with the Lookup Functions

Excel's lookup function enables you to perform range lookups that either return information about entries in the range or actually return related data to other ranges in the worksheet. By using lookup tables to input information into a range, you not only reduce the amount of data input that you have to do, but also eliminate the possibility of data entry errors. Using lookup tables also makes it a snap to update your data: All you have to do is make the edits to the entries in the original lookup table or schedule to have all their data entries in the list updated as well.

You can access the Lookup functions either via the Insert Function icon on the Formula bar, or via the Ribbon's Formulas tab by clicking the Lookup & Reference drop-down menu. The next few sections take you through the most common Lookup functions.

Modern lookups with XLOOKUP

In early February 2020, Microsoft released an Excel update for Microsoft 365 subscribers on Windows and Mac. That update included support for the XLOOKUP function, which Microsoft touted as a simpler and more versatile replacement for the very popular (yet oft maligned) lookup function VLOOKUP (and its horizontal cousin, HLOOKUP).

For those of you not yet familiar with VLOOKUP (deemed the third most-used function right after SUM and AVERAGE), this function searches vertically by row in the leftmost column of a lookup table from top to bottom until it finds a value in a lookup column specified by an offset number that matches or exceeds the one you're looking up. Although tremendously useful for locating particular items in a long list or column of a range in your worksheet, the VLOOKUP function has several limitations. Here's how XLOOKUP improves upon those limitations:

- XLOOKUP defaults to finding exact matches for your lookup value in the lookup range.
- XLOOKUP can search both vertically (by row) and horizontally (by column) in a table, thereby replacing the need for using the HLOOKUP function when searching horizontally by column.
- XLOOKUP can search left or right so that the lookup range in your lookup table does not have to be located in a column to the left of the one designated as the return range in order for the function to work.
- When the exact match default is used, XLOOKUP works even when values in the lookup range are not sorted in a particular order.
- XLOOKUP can search from the bottom row to the top in the lookup array range, using an optional search mode argument.

The XLOOKUP function has six arguments, the first three of which are required and the last three optional, using the following syntax:

```
XLOOKUP(lookup_value, lookup_array, return_array,
[if_not_found], [match_mode], [search_mode])
```

The *lookup_value* argument designates the value for which you're searching; the *look_up* array argument designates the range of cells to be searched for this lookup value; and the *return_array* argument designates the range of cells containing the value you want returned when Excel finds an exact match.

REMEMBER When designating the *lookup_array* and *return_array* arguments in your XLOOKUP function, both ranges must be of equal length, otherwise Excel returns the #VALUE! error to your formula. This is all the more reason for you to use range names or table column names when defining these arguments rather than pointing to them or typing their cell references.

The optional *if_not_found* argument specifies a text string to return to the formula if XLOOKUP fails to locate a matching value in the *lookup_array*.

The optional *match_mode* argument can contain any of the following four values:

- 0 for an exact match (the default, same as when no *match_mode* argument is designated)
- -1 for exact match or next lesser value
- 1 for exact match or next greater value
- 2 for partial match using wildcard characters: ? to match a single character and * to match any number of characters. To search for either a question mark or asterisk, precede the character with a tilde: ~? or ~*.

The optional *search_mode* argument can contain any of the following four values:

- 1 to search first-to-last, that is, from top to bottom (the default, same as when no *search_mode* argument is designated)

- -1 to search last-to-first, that is, bottom to top
- 2 for a binary search in ascending order
- -2 for binary search in descending order

The best way to understand the power and versatility of the XLOOKUP function is to see it in action in an Excel worksheet. In Figure 6-1 (sample workbook: Customer Sales by Country - Lookups.xslx), I have a worksheet with sales data arranged by country. To use XLOOKUP to return the total sales from this range in cell F4 based on the country you enter in cell E4 of the worksheet, you take these steps:

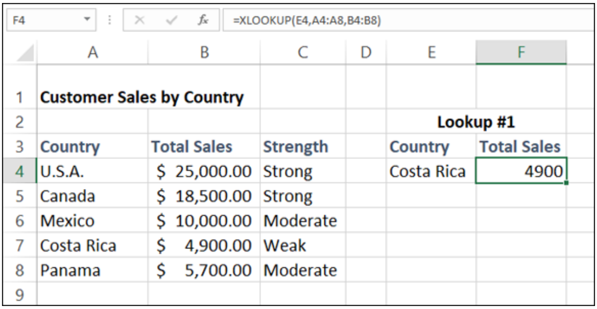
1. **Position the cell cursor in cell F4 of the worksheet.**
2. **On the Formulas tab, click Lookup & Reference and then click XLOOKUP.**

   Excel displays the Function Arguments dialog box.
3. **Click in the *Lookup_value* argument text box and then click cell E4.**
4. **Click in the *Lookup_array* argument text box, then select the range A4:A8.**

   A4:A8 is the range that XLOOKUP searches for whatever value you enter into cell E4.
5. **Click in the *Return_array* argument text box, and then select the range B4:B8.**

   B4:B8 is the range that that XLOOKUP uses to select the return value based on the results of the search.
6. **Click OK to enter the following XLOOKUP formula in cell F4:**

```
=XLOOKUP(E4, A4:A8, B4:B8)
```



`=XLOOKUP(E4,A4:A8,B4:B8)`

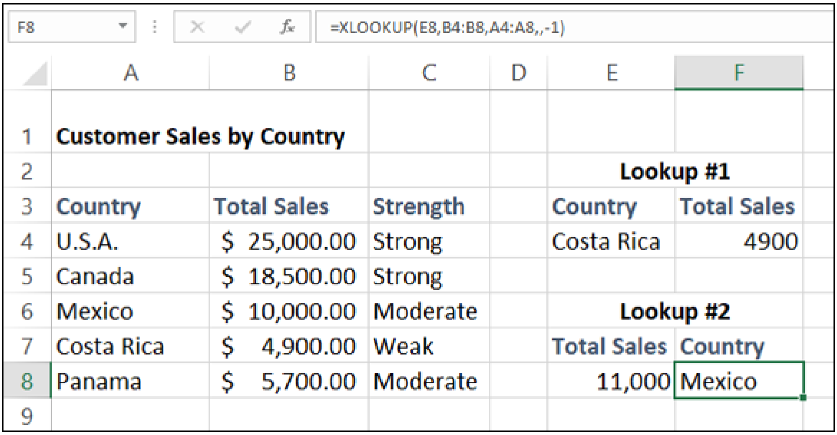
	A	B	C	D	E	F
1	**Customer Sales by Country**					
2					**Lookup #1**	
3	Country	Total Sales	Strength		Country	Total Sales
4	U.S.A.	$ 25,000.00	Strong		Costa Rica	4900
5	Canada	$ 18,500.00	Strong			
6	Mexico	$ 10,000.00	Moderate			
7	Costa Rica	$ 4,900.00	Weak			
8	Panama	$ 5,700.00	Moderate			
9						

FIGURE 6-1: The XLOOKUP formula in cell F4 returns sales based on the country entered in cell E4. (Sample workbook: Customer Sales by Country - Lookups.xslx)

In Figure 6-1, with Costa Rica entered into the lookup cell E4, XLOOKUP returns 4900 as the result because, as you can see in the sales table, this is indeed the total sales made for that country.

Because XLOOKUP works right-to-left just as well as left-to-right, you can use this function to return the country from this sales table based on a particular sales figure. Figure 6-2 (sample workbook: Customer Sales by Country - Lookups.xslx) shows you how you do this. This time, you create the XLOOKUP formula in cell F4 and designate the value entered in cell E4 (11,000, in this case) as the *lookup_value* argument.

In addition, you enter -1 as the *match_mode* argument to override the function's exact match default so that Excel returns the country with an exact match to the sales value entered in the lookup cell E4 or the one with the next lower total sales (Mexico with $10,000 in this case as there is no country in this table with $11,000 of total sales). Without designating a *match_mode* argument for this formula, Excel would return #NA as the result, because there's no exact match to $11,000 in this sales table.

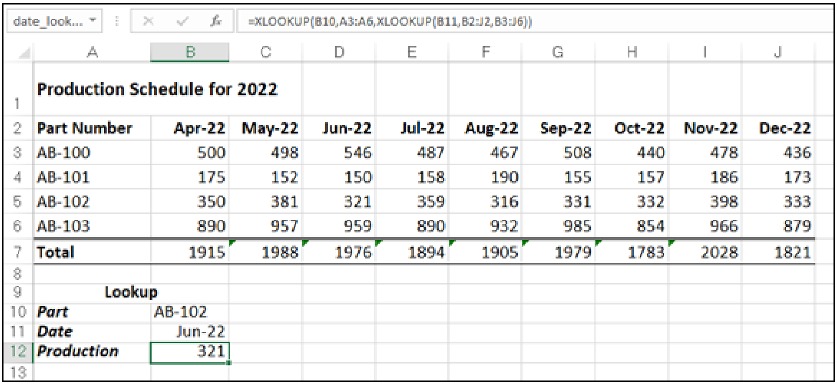


`=XLOOKUP(E8,B4:B8,A4:A8,,-1)`

	A	B	C	D	E	F
1	**Customer Sales by Country**					
2					**Lookup #1**	
3	Country	Total Sales	Strength		Country	Total Sales
4	U.S.A.	$ 25,000.00	Strong		Costa Rica	4900
5	Canada	$ 18,500.00	Strong			
6	Mexico	$ 10,000.00	Moderate		**Lookup #2**	
7	Costa Rica	$ 4,900.00	Weak		Total Sales	Country
8	Panama	$ 5,700.00	Moderate		11,000	Mexico
9						

FIGURE 6-2: The XLOOKUP formula in cell F4 returns the country based on the sales entered in cell E4. (Sample workbook: Customer Sales by Country - Lookups.xslx)

Because the XLOOKUP function is equally comfortable searching horizontally by column as it is searching vertically by row, you can use it to create a formula that performs a two-way lookup (replacing the need to create a formula that combines the INDEX and MATCH functions as in the past). Figure 6-3 (sample workbook: Production Schedule XLOOKUP.xlsx), containing the production schedule table for part numbers, AB-100 through AB-103 for the months April through December, shows you how this is done.



`=XLOOKUP(B10,A3:A6,XLOOKUP(B11,B2:J2,B3:J6))`

	A	B	C	D	E	F	G	H	I	J
1	**Production Schedule for 2022**									
2	**Part Number**	**Apr-22**	**May-22**	**Jun-22**	**Jul-22**	**Aug-22**	**Sep-22**	**Oct-22**	**Nov-22**	**Dec-22**
3	AB-100	500	498	546	487	467	508	440	478	436
4	AB-101	175	152	150	158	190	155	157	186	173
5	AB-102	350	381	321	359	316	331	332	398	333
6	AB-103	890	957	959	890	932	985	854	966	879
7	**Total**	1915	1988	1976	1894	1905	1979	1783	2028	1821
8										
9	**Lookup**									
10	***Part***	AB-102								
11	***Date***	Jun-22								
12	***Production***	321								
13										

FIGURE 6-3: A formula with nested XLOOKUP functions to return the number of units produced for a part in a particular month. (Sample workbook: Production Schedule XLOOKUP.xlsx)

In cell B12, I created the following formula:

```
=XLOOKUP(B10, A3:A6, XLOOKUP(B11, B2:J2, B3:J6))
```

The outer XLOOKUP function takes whatever part number is entered in cell B10 and searches vertically for an exact match in the range A3:A6 of the production table. Note that the *return_array* argument for this outer XLOOKUP function is itself a second XLOOKUP function.

This second, nested XLOOKUP function takes whatever date is entered in cell B11 and searches horizontally for an exact match in the range B2:J2. The *return_array* argument for this nested XLOOKUP function is B3:J6, the range of all production values in the table.

The way this formula works is that Excel first calculates the result of the second, nested XLOOKUP function by performing a horizontal search that, in this case, returns the array in cell range D3:D6 of the Jun-22 column (with the values: 546, 150, 321, and 959) as its result. This result, in turn, becomes the *return_array* argument for the outer XLOOKUP function that performs a vertical search by row for an exact match to the part number entry made in cell B10. Because, in this example, B10 contains AB-102, the formula returns just the Jun-22 production value for that part, 321, from the result of the nested XLOOKUP function.

There you have it! XLOOKUP is a powerful, versatile, and fairly easy-to-use lookup function that can not only do the single-value lookups performed by the VLOOKUP and HLOOKUP functions but also the two-way value lookups performed by combining the INDEX and MATCH functions as well (all of which I discuss in the sections that follow).

WARNING Unfortunately, the XLOOKUP function is not backward compatible with earlier versions of Microsoft Excel that only support the VLOOKUP and HLOOKUP functions. This means that if you share a workbook containing XLOOKUP formulas with co-workers or clients who are using a version of Excel that doesn’t support this new lookup function, all these formulas will return #NAME? error values when they open its worksheet.

Old-fashioned lookups with VLOOKUP and HLOOKUP

For the sake of completeness and to enable you to perform lookups in versions of Excel that don't support XLOOKUP, this section and the next take you through the old way of doing lookups in Excel: VLOOKUP and HLOOKUP in this section; INDEX and MATCH in the next section. Remember, however, that if you have a version of Excel that supports XLOOKUP and your worksheets will never be used by anyone with a version of Excel that is XLOOKUP-ignorant, then you can safely and smilingly skip these two sections.

The most popular of the lookup functions are HLOOKUP (for Horizontal Lookup) and VLOOKUP (for Vertical Lookup) functions. These functions are located on the Lookup & Reference drop-down menu on the Formulas tab of the Ribbon (Alt+MO) as well as in the Lookup & Reference category in the Insert Function dialog box. They are part of a powerful group of functions that can return values by looking them up in data tables.

The VLOOKUP function searches vertically (from top to bottom) the leftmost column of a lookup table until the program locates a value that matches or exceeds the one you are looking up. The HLOOKUP function searches horizontally (from left to right) the topmost row of a lookup table until it locates a value that matches or exceeds the one that you’re looking up.

The VLOOKUP function uses the following syntax:

```
VLOOKUP(lookup_value, table_array, col_index_num,
[range_lookup])
```

The HLOOKUP function follows the nearly identical syntax:

```
HLOOKUP(lookup_value, table_array, row_index_num,
[range_lookup])
```

In both functions, the *lookup_value* argument is the value that you want to look up in the lookup table, and *table_array* is the cell range or name of the lookup table that contains both the value to look up and the related value to return.

The *col_index_num* argument designates the column of the lookup table containing the values that are returned by the VLOOKUP function based on matching the value of the *lookup_value* argument against those in the table_array argument. You determine the *col_index_num* argument counting how many columns this column is over to the right from the first column of the vertical lookup table, and you include the first column of the lookup table in this count.

Similarly, the *row_index_num* argument designates the row containing the values that are returned by the HLOOKUP function in a horizontal table. You determine the *row_index_num* argument by counting how many rows down this row is from the top row of the horizontal lookup table. Again, you include the top row of the lookup table in this count.

The value you enter for the the *col_index_num* or *row_index_num* arguments in the VLOOKUP and HLOOKUP functions can't exceed the total number of columns or rows in the lookup table.

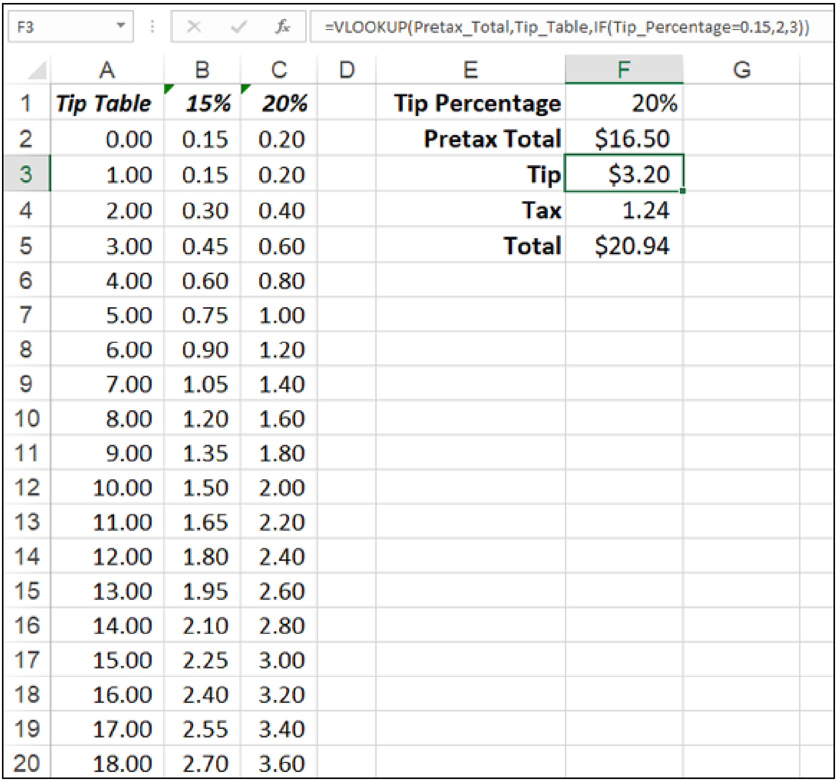
The optional *range_lookup* argument in both the VLOOKUP and the HLOOKUP functions is the logical TRUE or FALSE that specifies whether you want Excel to find an exact or approximate match for the *lookup_value* in the table_array. When you specify TRUE or omit the *range_lookup* argument in the VLOOKUP or HLOOKUP function, Excel finds an approximate match. When you specify FALSE as the *range_lookup* argument, Excel finds only exact matches.

Finding approximate matches pertains only when you're looking up numeric entries (rather than text) in the first column or row of the vertical or horizontal lookup table. When Excel doesn't find an exact match in this lookup column or row, it locates the next highest value that doesn't exceed the *lookup_value* argument and then returns the value in the column or row designated by the *col_index_num* or *row_index_num* arguments.

When using the VLOOKUP and HLOOKUP functions, the text or numeric entries in the lookup column or row (that is, the leftmost column of a vertical lookup table or the top row of a horizontal lookup table) must be unique. These entries must also be arranged or sorted in ascending order; that is, alphabetical order for text entries, and lowest-to-highest order for numeric entries. (See Book 6, Chapter 1 for detailed information on sorting data in a worksheet.)

Figure 6-4 (sample workbook: Tip Table VLOOKUP.xlsx) shows an example of using the VLOOKUP function to return either a 15% or 20% tip from a tip table, depending on the pretax total of the check. Cell F3 contains the VLOOKUP function:

```
=VLOOKUP(Pretax_Total, Tip_Table, IF(Tip_Percentage = 0.15, 2,
3))
```



```
=VLOOKUP(Pretax_Total,Tip_Table,IF(Tip_Percentage=0.15,2,3))
```

	A	B	C	D	E	F	G
1	*Tip Table*	*15%*	*20%*		**Tip Percentage**	20%	
2	0.00	0.15	0.20		**Pretax Total**	$16.50	
3	1.00	0.15	0.20		**Tip**	$3.20	
4	2.00	0.30	0.40		**Tax**	1.24	
5	3.00	0.45	0.60		**Total**	$20.94	
6	4.00	0.60	0.80				
7	5.00	0.75	1.00				
8	6.00	0.90	1.20				
9	7.00	1.05	1.40				
10	8.00	1.20	1.60				
11	9.00	1.35	1.80				
12	10.00	1.50	2.00				
13	11.00	1.65	2.20				
14	12.00	1.80	2.40				
15	13.00	1.95	2.60				
16	14.00	2.10	2.80				
17	15.00	2.25	3.00				
18	16.00	2.40	3.20				
19	17.00	2.55	3.40				
20	18.00	2.70	3.60				

FIGURE 6-4: Using the VLOOKUP function to return the amount of the tip to add from a Lookup table. (Sample workbook: Tip Table VLOOKUP.xlsx)

This formula returns the amount of the tip based on the tip percentage in cell F1 and the pretax amount of the check in cell F2.

To use this tip table, enter the percentage of the tip (15% or 20%) in cell F1 (named Tip_Percentage) and the amount of the check before tax in cell F2 (named Pretax_Total). Excel then looks up the value that you enter in the Pretax_Total cell in the first column of the lookup table, which includes the cell range A2:C101 and is named Tip_Table.

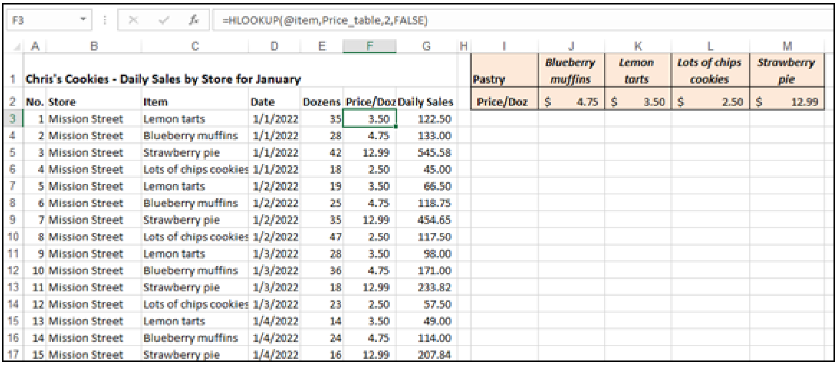
Excel then moves down the values in the first column of Tip_Table until it finds a match, whereupon the program uses the *col_index_num* argument in the VLOOKUP function to determine which tip amount from that row of the table to return to cell F3. If Excel finds that the value entered in the Pretax_Total cell ($16.50 in this example) doesn't exactly match one of the values in the first column of Tip_Table, the program continues to search down the comparison range until it encounters the first value that exceeds the pretax total (17.00 in cell

A19 in this example). Excel then moves back up to the previous row in the table and returns the value in the column that matches the *col_index_num* argument of the VLOOKUP function. (This is because the optional *range_lookup* argument has been omitted from the function.)

Note that the tip table example in Figure 6-4 uses an IF function to determine the *col_index_num* argument for the VLOOKUP function in cell F3. The IF function determines the column number to be used in the tip table by matching the percentage entered in Tip_Percentage (cell F1) with 0.15. If they match, the function returns 2 as the *col_index_num* argument, and the VLOOKUP function returns a value from the second column (the 15% column B) in the Tip_Table range. Otherwise, the IF function returns 3 as the *col_index_num* argument, and the VLOOKUP function returns a value from the third column (the 20% column C) in the Tip_Table range.

Figure 6-5 (sample workbook: Chris's Cookies - January Sales HLOOKUP.xlsx) shows an example that uses the HLOOKUP function to look up the price of each bakery item stored in a separate price lookup table and then to return that price to the Price/Doz column of the Daily Sales list. Cell F3 contains the original formula with the HLOOKUP function that is then copied down column F:

```
=HLOOKUP(@item, Price_table, 2, FALSE)
```



Chris's Cookies - Daily Sales by Store for January

No.	Store	Item	Date	Dozens	Price/Doz	Daily Sales
1	Mission Street	Lemon tarts	1/1/2022	35	3.50	122.50
2	Mission Street	Blueberry muffins	1/1/2022	28	4.75	133.00
3	Mission Street	Strawberry pie	1/1/2022	42	12.99	545.58
4	Mission Street	Lots of chips cookies	1/1/2022	18	2.50	45.00
5	Mission Street	Lemon tarts	1/2/2022	19	3.50	66.50
6	Mission Street	Blueberry muffins	1/2/2022	25	4.75	118.75
7	Mission Street	Strawberry pie	1/2/2022	35	12.99	454.65
8	Mission Street	Lots of chips cookies	1/2/2022	47	2.50	117.50
9	Mission Street	Lemon tarts	1/3/2022	28	3.50	98.00
10	Mission Street	Blueberry muffins	1/3/2022	36	4.75	171.00
11	Mission Street	Strawberry pie	1/3/2022	18	12.99	233.82
12	Mission Street	Lots of chips cookies	1/3/2022	23	2.50	57.50
13	Mission Street	Lemon tarts	1/4/2022	14	3.50	49.00
14	Mission Street	Blueberry muffins	1/4/2022	24	4.75	114.00
15	Mission Street	Strawberry pie	1/4/2022	16	12.99	207.84

Pastry	*Blueberry muffins*	*Lemon tarts*	*Lots of chips cookies*	*Strawberry pie*
Price/Doz	$ 4.75	$ 3.50	$ 2.50	$ 12.99

FIGURE 6-5: Using the HLOOKUP function to return the price of a bakery item from a lookup table. (Sample workbook: Chris's Cookies - January Sales HLOOKUP.xlsx)

In this HLOOKUP function, the range name Item that's given to the Item column in the range C3:C62 is defined as the *lookup_value* argument and the cell range name Price table that's given to the cell range I1:M2 is the *table_array* argument. The *row_index_num* argument is 2 because you want Excel to return the prices in the second row of the

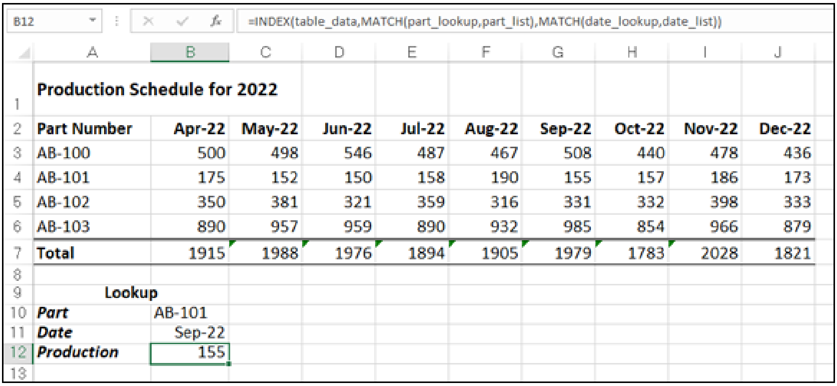
Prices Lookup table, and the optional *range_lookup* argument is FALSE because the item name in the Daily Sales list must match exactly the item name in the Prices lookup table.

By having the HLOOKUP function use the Price table range to input the price per dozen for each bakery goods item in the Daily Sales list, you make it a very straightforward matter to update any of the sales in the list. All you have to do is change its Price/Doz cost in this range, and the HLOOKUP function immediately updates the new price in the Daily Sales list wherever the item is sold.

Performing an old-fashioned two-way lookup with MATCH and INDEX

In both the VLOOKUP and HLOOKUP examples, Excel only compares a single value in the data list to a single value in the vertical or horizontal lookup table. Sometimes, however, you may have a table in which you need to perform a two-way lookup, whereby a piece of data is retrieved from the lookup table based on looking up a value in the top row (with the table's column headings) and a value in the first column (with the table's row headings).

Figure 6-6 (sample workbook: Production Schedule MATCH and INDEX Lookup.xlsx) illustrates a situation in which you would use two values, the production date, and the part number to look up the expected production. In the Production Schedule table, the production dates for each part form the column headings in the first row of the table, and the part numbers form the row headings in its first column of the table.



```
=INDEX(table_data,MATCH(part_lookup,part_list),MATCH(date_lookup,date_list))
```

	A	B	C	D	E	F	G	H	I	J
1	**Production Schedule for 2022**									
2	**Part Number**	**Apr-22**	**May-22**	**Jun-22**	**Jul-22**	**Aug-22**	**Sep-22**	**Oct-22**	**Nov-22**	**Dec-22**
3	AB-100	500	498	546	487	467	508	440	478	436
4	AB-101	175	152	150	158	190	155	157	186	173
5	AB-102	350	381	321	359	316	331	332	398	333
6	AB-103	890	957	959	890	932	985	854	966	879
7	**Total**	1915	1988	1976	1894	1905	1979	1783	2028	1821
8										
9	**Lookup**									
10	***Part***	AB-101								
11	***Date***	Sep-22								
12	***Production***	155								
13										

FIGURE 6-6: Doing a two-way lookup in the Production Schedule table. (Sample workbook: Production Schedule MATCH and INDEX Lookup.xlsx)

To look up the number of the part scheduled to be produced in a particular month, you need to the use the MATCH function, which returns the relative position of a particular value in a cell range or array. The syntax of the MATCH function is as follows:

```
MATCH(lookup_value, lookup_array, [match_type])
```

The *lookup_value* argument is, of course, the value whose position you want returned when a match is found, and the *lookup_array* is the cell range or array containing the values that you want to match. The optional *match_type* argument is the number 1, 0, or –1, which specifies how Excel matches the value specified by the *lookup_value* argument in the range specified by the *lookup_array* argument:

- Use *match_type 1* to find the largest value that is less than or equal to the *lookup_value.* Note that the values in the *lookup_array* must be placed in ascending order when you use the 1 *match_type* argument. (Excel uses this type of matching when the *match_type* argument is omitted from the MATCH function.)
- Use *match_type 0* to find the first value that is exactly equal to the *lookup_value*. Note that the values in the *lookup_array* can be in any order when you use the 0 *match_type* argument.
- Use *match_type –1* to find the smallest value that is greater than or equal to the *lookup_value.* Note that the values in the *lookup_array* must be placed in descending order when you use the –1 *match_type* argument.

In addition to looking up the position of the production date and part number in the column and row headings in the Production Schedule table, you need to use an INDEX function, which uses the relative row and column number position to return the number to be produced from the table itself. The INDEX function uses two different syntax forms: array and reference. You use the array form when you want a value returned from the table (as you do in this example), and you use the reference form when you want a reference returned from the table.

The syntax of the array form of the INDEX function is as follows:

```
INDEX(array, [row_num], [col_num])
```

The syntax of the reference form of the INDEX function is as follows:

```
INDEX(reference, [row_num], [col_num], [area_num])
```

The *array* argument of the array form of the INDEX function is a range of cells or an array constant that you want Excel to use in the lookup. If this range or constant contains only one row or column, the corresponding *row_num* or *col_num* arguments are optional. If the range or array constant has more than one row or more than one column, and you specify both the *row_num* and the *col_num* arguments, Excel returns the value in the *array* argument that is located at the intersection of the *row_num* argument and the *col_num* argument.

For the MATCH and INDEX functions in the example shown in Figure 6-6, I assigned the following range names to the following cell ranges:

- table_data to the cell range A2:J6 with the production data plus column and row headings
- part_list to the cell range A2:A6 with the row headings in the first column of the table
- date_list to the cell range A2:J2 with the column headings in the first row of the table
- part_lookup to cell B10 that contains the name of the part to look up in the table
- date_lookup to cell B11 that contains the name of the production date to look up in the table

As Figure 6-6 shows, cell B12 contains a rather long and — at first glance — complex formula using the range names outlined previously and combining the INDEX and MATCH functions:

```
=INDEX(table_data, MATCH(part_lookup, part_list),
MATCH(date_lookup, date_list))
```

So you can better understand how this formula works, I break the formula down into its three major components: the first MATCH function that returns the *row_num* argument for the INDEX function, the second MATCH function that returns the *col_num* argument for the INDEX function, and the INDEX function itself that uses the values returned by the two MATCH functions to return the number of parts produced.

The first MATCH function that returns the *row_num* argument for the INDEX function is

```
MATCH(part_lookup, part_list)
```

This MATCH function uses the value input into cell B10 (named part_lookup) and looks up its position in the cell range A2:A6 (named part_list). It then returns this row number to the INDEX function as its *row_num* argument. In the case of the example shown in Figure 6-6 where part AB-101 is entered in the part_lookup cell in B10, Excel returns 3 as the *row_num* argument to the INDEX function.

The second MATCH function that returns the *col_num* argument for the INDEX function is

```
MATCH(date_lookup, date_list)
```

This second MATCH function uses the value input into cell B11 (named date_lookup) and looks up its position in the cell range A2:J2 (named date_list). It then returns this column number to the INDEX function as its *col_num* argument. In the case of the example shown in Figure 6-6 where September 1, 2022 (formatted as Sep-22), is entered in the date_lookup cell in B11, Excel returns 7 as the *col_num* argument to the INDEX function.

This means that for all its supposed complexity, the INDEX function shown on the Formula bar in Figure 6-6 contains the equivalent of the following formula:

```
=INDEX(table_data, 3, 7)
```

As Figure 6-6 shows, Excel returns 155 units as the planned production value for part AB-101 in September 2022. You can verify that this is correct by manually counting the rows and the columns in the table_data range (cell range A2:J6). If you count down three rows (including row 2, the first row of this range), you come to Part 101 in column A. If you then count seven columns over (including column A with AB-101), you come to cell G4 in the Sep-16 column with the value 155.

Getting Cell Reference Info with the Reference Functions

The reference functions in Excel enable you to return specific information about particular cells or parts of the worksheet; create hyperlinks to different documents on your computer, network, or the Internet; and transpose ranges of vertical cells so that they run horizontally and vice versa.

You can access the Reference functions either via the Insert Function icon on the Formula bar, or via the Ribbon's Formulas tab by clicking the Lookup & Reference drop-down menu. This group of functions includes:

- **ADDRESS:** Returns a cell reference as a text entry in a cell of the worksheet
- **AREAS:** Returns the number of areas in a list of values (*areas* are defined as a range of contiguous cells or a single cell in the cell reference)
- **COLUMN:** Returns the number representing the column position of a cell reference
- **COLUMNS:** Returns the number of columns in a reference
- **FORMULATEXT:** Returns the formula referenced as a text string
- **GETPIVOTDATA:** Returns data stored in an Excel pivot table (see Book 7, Chapter 2 for details)
- **HYPERLINK:** Creates a link that opens another document stored on your computer, network, or the Internet (you can also do this by choosing Insert⇒ Hyperlink; see Book 4, Chapter 2 for details)
- **INDIRECT:** Returns a cell reference specified by a text string and bring the contents in the cell to which it refers to that cell
- **LOOKUP:** Returns a value from an array
- **OFFSET:** Returns a reference to a cell range that's specified by the number of rows and columns from a cell or a cell range
- **ROW:** Returns the row number of a cell reference
- **ROWS:** Returns the number of rows in a cell range or array
- **RTD:** Returns real-time data from a server running a program that supports COM (Component Object Model) automation
- **TRANSPOSE:** Returns a vertical array as a horizontal array and vice versa

Get the skinny on columns and rows

The COLUMNS and ROWS functions return the number of columns and rows in a particular cell range or array. For example, if you have a cell range in the worksheet named product_mix, you can find out how many columns it contains by entering this formula:

```
=COLUMNS(product_mix)
```

If you want to know how many rows this range uses, you then enter this formula:

```
=ROWS(product_mix)
```

As indicated in the previous chapter, you can use the COLUMNS and ROWS functions together to calculate the total number of cells in a particular range. For example, if you want to know the exact number of cells used in the product_mix cell range, you create the following simple multiplication formula by using the COLUMNS and ROWS functions:

```
=COLUMNS(product_mix) * ROWS(product_mix)
```

REMEMBER Don’t confuse the COLUMNS (plural) function with the COLUMN (singular) function and the ROWS (plural) function with the ROW (singular) function. The COLUMN function returns the number of the column (as though Excel were using the R1C1 reference system) for the cell reference that you specify as its sole argument. Likewise, the ROW function returns the number of the row for the cell reference that you specify as its argument.

Transposing cell ranges

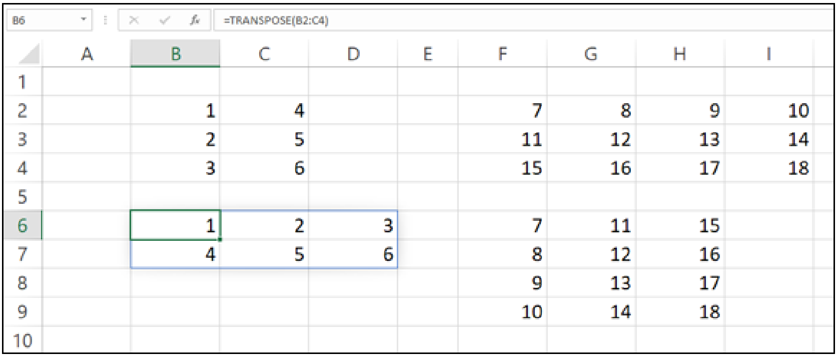
The TRANSPOSE function enables you to change the orientation of a cell range (or an array — see the section on entering array formulas in Book 3, Chapter 1 for details). You can use this function to transpose a vertical cell range where the data runs down the rows of adjacent columns to one where the data runs across the columns of adjacent rows and vice versa.

Suppose that you want to transpose the data entered into the range A10:C11 (a 2 x 3 array) to the range E10:F12 (a 3 x 2 array) of the worksheet. After first making sure that there's no existing data in the range E10:F12, you'd enter the following formula into cell E10:

```
=TRANSPOSE(A10:C11)
```

Figure 6-7 (sample workbook: TRANSPOSE Example.xlsx) illustrates the use of the TRANSPOSE function. The cell range B2:C4 contains the original 3 x 2 array that I want to transpose. To convert this 3 x 2 array to a 2 x 3 array in the range B6:D7, I entered the following formula in cell B6:

```
=TRANSPOSE(B2:C4)
```



B6

=TRANSPOSE(B2:C4)

	A	B	C	D	E	F	G	H	I
1									
2		1	4			7	8	9	10
3		2	5			11	12	13	14
4		3	6			15	16	17	18
5									
6		1	2	3		7	11	15	
7		4	5	6		8	12	16	
8						9	13	17	
9						10	14	18	
10									

FIGURE 6-7: Using the TRANSPOSE function to change the orientation of a simple array. (Sample workbook: TRANSPOSE Example.xlsx)

Similarly in Figure 6-7, to transpose the 4 x 3 array in the range F2:I4 to the 3 x 4 range F6:H9, I entered the following formula into cell F6:

```
=TRANSPOSE(F2:I4)
```

WARNING The TRANSPOSE examples in this section assume you're using a version of Excel that supports dynamic arrays. If you're using Excel 2016 or earlier, you need to select the entire destination array, type your TRANSPOSE formula, and then complete it by pressing Ctrl + Shift + Enter.

TIP If all you want to do is transpose row and column headings or a simple table of data, you don’t have to go through the rigmarole of creating an array formula using the TRANSPOSE function. Copy the range of cells to be transposed, position the cell cursor in the first empty cell where the transposed range is to be pasted, and then choose Paste⇒ Transpose.

Interrogating Excel

The information functions are designed to test the contents of a cell or cell range and give you information on its current contents. You can access the Information functions either via the Insert Function icon on the Formula bar, or via the Ribbon's Formulas tab by choosing More Functions⇒ Information.

These kinds of information functions are often combined with IF functions, which determine what type of calculation, if any, to perform. The information function then becomes the *logical_test* argument of the IF function, and the outcome of the test, expressed as the logical TRUE or logical FALSE value, decides whether its *value_if_true* or its *value_if_false* argument is executed. (See Book 3, Chapter 2 for information on using information functions that test for error values to trap errors in a worksheet.)

In addition to the many information functions that test whether the contents of a cell are of a certain type, Excel offers a smaller set of functions that return coded information about a cell's contents or formatting and about the current operating environment in which the workbook is functioning. The program also offers an N (for Number) function that returns the value in a cell and an NA (for Not Available) function that inserts the #N/A error value in the cell.

Getting information about a cell

The CELL function is the basic information function for getting all sorts of data about the contents and formatting of a cell. The syntax of the CELL function is

```
CELL(info_type, [reference])
```

The *info_type* argument is a text value that specifies the type of cell information you want returned. The optional *reference* argument is the reference of the cell range for which you want information. When you omit this argument, Excel specifies the type of information given by the *info_type* argument for the last cell that was changed in the worksheet. When you specify a cell range as the *reference* argument, Excel returns the type of information given by the *info_type* argument for the first cell in the range (that is, the one in the upper-left corner, which may or may not be the active cell of the range).

Table 6-1 shows the various *info_type* arguments that you can specify when using the CELL function. Remember that you must enclose each *info_type* argument in the CELL function in double-quotes (to enter them as text values) to prevent Excel from returning the #NAME? error value to the cell containing the CELL function formula. So, for example, if you want to return the contents of the first cell in the range B10:E80, you enter the following formula:

```
=CELL("contents",B10:E80)
```

TABLE 6-1 The CELL Functions *info_type* Arguments

CELL Function info_type Argument	*Returns This Information*
"address"	Address of the first cell in the reference as text using absolute cell references
"col"	Column number of the first cell in the reference
"color"	1 when the cell is formatted in color for negative values; otherwise returns 0 (zero)
"contents"	Value of the upper-left cell in the reference
"filename"	Filename (including the full pathname) of the file containing the cell reference: returns empty text ("") when the workbook containing the reference has not yet been saved
"format"	Text value of the number format of the cell (see Table 6-2): Returns "-" at the end of the text value when the cell is formatted in color for negative values and "()" when the value is formatted with parentheses for positive values or for all values
"parentheses"	1 when the cell is formatted with parentheses for positive values or for all values
"prefix"	Text value of the label prefix used in the cell: Single quote (') when text is left-aligned; double quote (") when text is right-aligned; caret (^) when text is centered; backslash (\) when text is fill-aligned; and empty text ("") when the cell contains any other type of entry
"protect"	0 when the cell is unlocked and 1 when the cell is locked (see Book 4, Chapter 1 for details on protecting cells in a worksheet)
"row"	Row number of the first cell in the reference
"type"	Text value of the type of data in the cell: "b" for blank when cell is empty; "l" for label when cell contains text constant; and "v" for value when cell contains any other entry
"width"	Column width of the cell rounded off to the next highest integer (each unit of column width is equal to the width of one character in Excel's default font size)

Table 6-2 shows the different text values along with their number formats (codes) that can be returned when you specify "format" as the *info_type* argument in a CELL function. (Refer to Book 2, Chapter 3 for details on number formats and the meaning of the various number format codes.)

TABLE 6-2 Text Values Returned by the "format" *info_type*

Number Formatting	*Text Value*
General	"G"
0	"F0"
#,##0	",0"
0.00	"F2"
#,##0.00	",2"
$#,##0_);($#,##0)	"C0"
$#,##0_);[Red]($#,##0)	"C0-"
$#,##0.00_);($#,##0.00)	"C2"
$#,##0.00_);[Red]($#,##0.00)	"C2-"

0%	“P0”
0.00%	“P2”
0.00E+00	“S2”
# ?/? or # ??/??	“G”
m/d/yy or m/d/yy h:mm or mm/dd/yy	“D4”
d-mmm-yy or dd-mmm-yy	“D1”
d-mmm or dd-mmm	“D2”
mmm-yy	“D3”
mm/dd	“D5”
h:mm AM/PM	“D7”
h:mm:ss AM/PM	“D6”
h:mm	“D9”
h:mm:ss	“D8”

For example, if you use the CELL function that specifies “format” as the *info_type* argument on cell range A10:C28 (which you’ve formatted with the Comma style button on the Formula bar), as in the following formula

```
=CELL("format”, A10:C28)
```

Excel returns the text value “,2-” (without the quotation marks) in the cell where you enter this formula signifying that the first cell uses the Comma style format with two decimal places and that negative values are displayed in color (red) and enclosed in parentheses.

Are you my TYPE?

Excel provides another information function that returns the type of value in a cell. Aptly named, the TYPE function enables you to build formulas with the IF function that execute one type of behavior when the cell being tested contains a value and another when it contains text. The syntax of the TYPE function is

TYPE(*value*)

The *value* argument of the TYPE function can be any Excel entry: text, number, logical value, or even an error value or a cell reference that contains such a value. The TYPE function returns the following values, indicating the type of contents:

- 1 for numbers
- 2 for text
- 4 for logical value (TRUE or FALSE)
- 16 for error value
- 64 for an array range or constant (see Book 3, Chapter 1)

The following formula combines the CELL and TYPE functions nested within an IF function. This formula returns the type of the number formatting used in cell D11 only when the cell contains a value. Otherwise, it assumes that D11 contains a text entry, and it evaluates the type of alignment assigned to the text in that cell:

```
=IF(TYPE(D11) = 1, CELL("format", D11), CELL("prefix", D11))
```

Using the IS functions

The IS information functions (as in ISBLANK, ISERR, and so on) are a large group of functions that work in essentially the same way. They evaluate a value or cell reference and return the logical TRUE or FALSE, depending on whether the value is or isn't the type for which the IS function tests. For example, if you use the ISBLANK function to test the contents of cell A1 as in

```
=ISBLANK(A1)
```

Excel returns TRUE to the cell containing the formula when A1 is empty and FALSE when it's occupied by any type of entry.

Excel offers a dozen built-in IS information functions:

- **ISBLANK(*value*):** Evaluates whether the value or cell reference is empty.
- **ISERR(*value*):** Evaluates whether the value or cell reference contains an Error value (except for #N/A).
- **ISERROR(*value*):** Evaluates whether the value or cell reference contains an Error value (including #N/A).
- **ISEVEN(*value*):** Evaluates whether the value in the referenced cell is even (TRUE) or odd (FALSE).
- **ISFORMULA(*value*):** Evaluates whether the value or cell reference contains a formula.
- **ISLOGICAL(*value*):** Evaluates whether the value or cell reference contains the logical TRUE or FALSE value.
- **ISNA(*value*):** Evaluates whether the value or cell reference contains the special #N/A Error value.
- **ISNONTEXT(*value*):** Evaluates whether the value or cell reference contains any type of entry other than text.

- **ISNUMBER(*value*):** Evaluates whether the value or cell reference contains a number.
- **ISODD(*number*):** Evaluates whether the value in the referenced cell is odd (TRUE) or even (FALSE).
- **ISREF(*value*):** Evaluates whether the value or cell reference is itself a cell reference.
- **ISTEXT(*value*):** Evaluates whether the value or cell reference contains a text entry.

For an example of how to use the ISERROR function, refer to the section on error trapping in Book 3, Chapter 2.

Working with Text Functions and Formulas

Normally, when you think of doing calculations in a worksheet, you think of performing operations on its numeric entries. You can, however, use the text functions as well as the concatenation operator (&) to perform operations on its text entries as well (referred to collectively as *string operations*).

Using text functions

Text functions found on the Text command button's drop-down menu on the Ribbon's Formulas tab (Alt+MT) include two types of functions: functions such as VALUE, TEXT, and DOLLAR that convert numeric text entries into numbers and numeric entries into text, and functions such as UPPER, LOWER, and PROPER that manipulate the strings of text themselves.

Many times, you need to use the text functions when you work with data from other programs. For example, suppose that you purchase a target client list on disk, only to discover that all the information has been entered in all uppercase letters. To use this data with your word processor's mail merge feature, you would use Excel's PROPER function to convert the entries so that only the initial letter of each word is in uppercase.

Text functions such as the UPPER, LOWER, and PROPER functions all take a single *text* argument that indicates the text that should be manipulated. The UPPER function converts all letters in the *text* argument to uppercase. The LOWER function converts all letters in the *text* argument to lowercase. The PROPER function capitalizes the first letter of each word as well as any other letters in the *text* argument that don't follow another letter and changes all other letters in the *text* argument to lowercase.

Figure 6-8 (sample workbook: Client List.xlsx) illustrates a situation in which you would use the PROPER function. Here, both last and first name text entries have been made in all uppercase letters. Follow these steps for using the PROPER function to convert text entries to the proper capitalization:

1. **Position the cell cursor in cell C3, click the Text command button on the Ribbon's Formulas tab (or press Alt+MT), and then choose PROPER from its drop-down menu.**

   The Function Arguments dialog box for the PROPER function opens with the Text box selected.

2. **Click cell A3 in the worksheet to insert A3 in the Text box of the Function Arguments dialog box and then click OK to insert the PROPER function into cell C3.**

   Excel closes the Insert Function dialog box and inserts the formula `=PROPER(A3)` in cell C3, which now contains the proper capitalization of the last name Aiken.

3. **Drag the fill handle in the lower-right corner of cell C3 to the right to cell D3 and then release the mouse button to copy the formula with the PROPER function to this cell.**

   Excel now copies the formula `=PROPER(B3)` to cell D3, which now contains the proper capitalization of the first name, Christopher. Now you're ready to copy these formulas with the PROPER function down to row 17.

4. **Drag the fill handle in the lower-right corner of cell D3 down to cell D17 and then release the**

mouse button to copy the formulas with the PROPER function down.

The cell range C3:D17 now contains first and last name text entries with the proper capitalization. (See Figure 6-8.) Before replacing all the uppercase entries in A3:B17 with these proper entries, you convert them to their calculated values. This action replaces the formulas with the text as though you had typed each name in the worksheet.

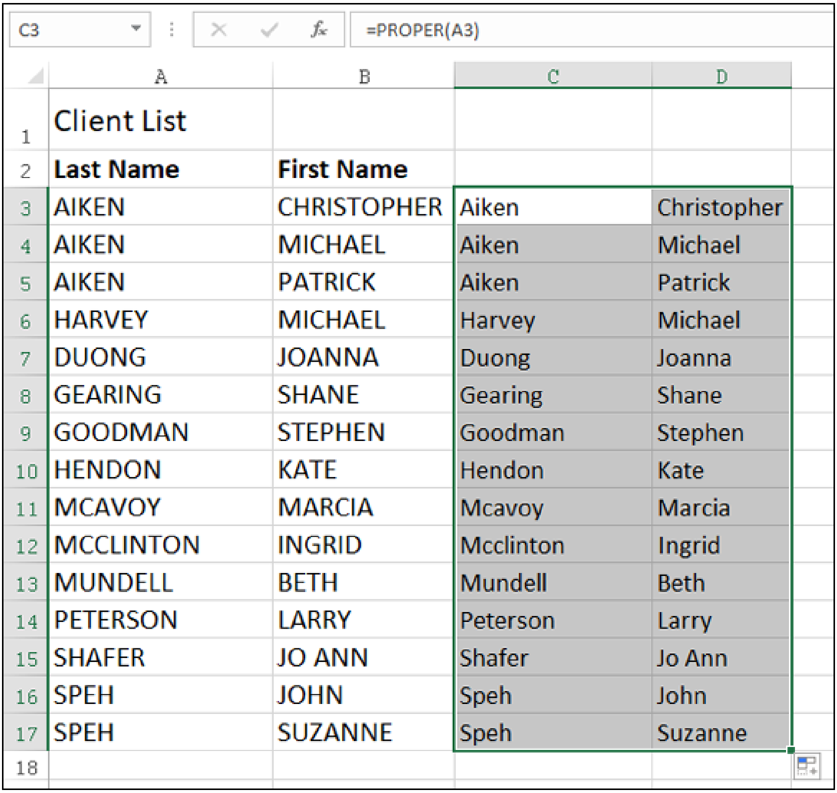
5. **With the cell range C3:D17 still selected, click the Copy command button on the Home tab of the Ribbon.**
6. **Immediately choose the Paste Values option from the Paste command button's drop-down menu.**

   You've now replaced the formulas with the appropriate text. Now you're ready to move this range on top of the original range with the all-uppercase entries. This action replaces the uppercase entries with the ones using the proper capitalization.

7. **With the cell range C3:D17 still selected, position the white-cross mouse or Touch pointer on the bottom of the range; when the pointer changes to an arrowhead, drag the cell range until its outline encloses the range A3:B17 and then release the mouse button or remove your finger or stylus from the touchscreen.**

   Excel displays an alert box asking whether you want the program to replace the contents of the destination's cells.

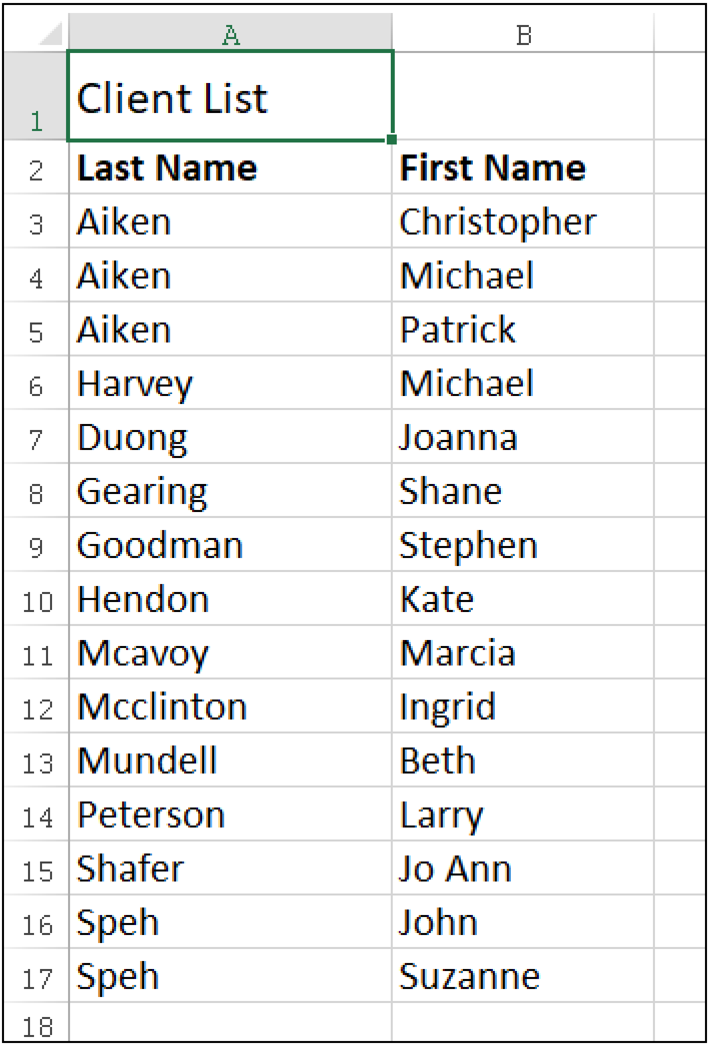
8. **Click OK in the Alert dialog box to replace the all-uppercase entries with the properly capitalized ones in the destination cells.**



	A	B	C	D
1	Client List			
2	**Last Name**	**First Name**		
3	AIKEN	CHRISTOPHER	Aiken	Christopher
4	AIKEN	MICHAEL	Aiken	Michael
5	AIKEN	PATRICK	Aiken	Patrick
6	HARVEY	MICHAEL	Harvey	Michael
7	DUONG	JOANNA	Duong	Joanna
8	GEARING	SHANE	Gearing	Shane
9	GOODMAN	STEPHEN	Goodman	Stephen
10	HENDON	KATE	Hendon	Kate
11	MCAVOY	MARCIA	Mcavoy	Marcia
12	MCCLINTON	INGRID	Mcclinton	Ingrid
13	MUNDELL	BETH	Mundell	Beth
14	PETERSON	LARRY	Peterson	Larry
15	SHAFER	JO ANN	Shafer	Jo Ann
16	SPEH	JOHN	Speh	John
17	SPEH	SUZANNE	Speh	Suzanne
18				

FIGURE 6-8: Using the PROPER function to convert names in all uppercase letters to proper capitalization. (Sample workbook: Client List.xlsx)

Your worksheet now looks like the one shown in Figure 6-9 (sample workbook: Client List.xlsx). Everything is fine in the worksheet with the exception of the two last names, Mcavoy and Mcclinton. You have to manually edit cells A11 and A12 to capitalize the *A* in McAvoy and the second *C* in McClinton.



	A	B
1	Client List	
2	**Last Name**	**First Name**
3	Aiken	Christopher
4	Aiken	Michael
5	Aiken	Patrick
6	Harvey	Michael
7	Duong	Joanna
8	Gearing	Shane
9	Goodman	Stephen
10	Hendon	Kate
11	Mcavoy	Marcia
12	Mcclinton	Ingrid
13	Mundell	Beth
14	Peterson	Larry
15	Shafer	Jo Ann
16	Speh	John
17	Speh	Suzanne
18		

FIGURE 6-9: Worksheet after replacing names in all uppercase letters with properly capitalized names. (Sample workbook: Client List.xlsx)

The T function

The T text function enables you to test whether a cell entry somewhere else in the workbook contains text. It does this by testing the entry specified in its sole *value* argument as in

```
=T(C28)
```

If cell C28 in this example does currently contain a text entry, the T function displays that text in the cell containing the T function formula. If C28 currently contains anything else besides text, Excel puts empty text (with double quotes with nothing inside them) in the cell with the T function formula that makes it appear as though that cell is blank.

TEXTJOIN function

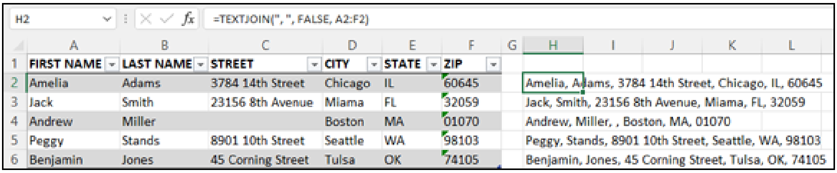
The TEXTJOIN function gives you a new and easy way to join together text entered into separate cells of a worksheet into one long text entry with each of its erstwhile individual text entries separated by whatever delimiting character you choose to use. This function is useful for those times when you have data lists that need to be exported to an external database program. The most common situation is when you need to convert to an Excel data list into a CSV (Comma Separated Value) text file that can be directly imported into an external database app. The TEXTJOIN function uses the following syntax:

```
=TEXTJOIN(delimiter, ignore_empty, text1, [text2],…)
```

To see how this may work, consider the example shown in Figure 6-10 (sample workbook: TEXTJOIN.xlsx). Here, I have entered a data list into the cell range A1:F6 with clients names and addresses. To make it easy to sort and query this data, I have formatted this list as an Excel table. To save this data in a CSV text file ready for export to another program, I use the TEXTJOIN function, designating the comma (",") as the delimiter as follows:

```
=TEXTJOIN(",", FALSE, A2:F2)
```

In CSV files, individual fields (such as First Name, Last Name, and so on) are normally separated by commas (although spaces and tabs are also used), and individual records (Amelia Adams, Jack Smith, and so on) are separated by link breaks (designated in a worksheet by the different rows). So for this original TEXTJOIN formula, I designate the comma as the initial *delimiter* argument (enclosed in double quotes). I then designate the *ignore_empty* argument as FALSE. This is a required logical argument that tells Excel whether to skip cells in the list that are blank. Finally, I designate the cell range A2:F2 as the sole text argument as it contains all name and address data that comprise Amelia Adams's record.



H2

=TEXTJOIN(", ", FALSE, A2:F2)

	A	B	C	D	E	F	G	H	I	J	K	L
1	FIRST NAME	LAST NAME	STREET	CITY	STATE	ZIP						
2	Amelia	Adams	3784 14th Street	Chicago	IL	60645		Amelia, Adams, 3784 14th Street, Chicago, IL, 60645				
3	Jack	Smith	23156 8th Avenue	Miama	FL	32059		Jack, Smith, 23156 8th Avenue, Miama, FL, 32059				
4	Andrew	Miller		Boston	MA	01070		Andrew, Miller, , Boston, MA, 01070				
5	Peggy	Stands	8901 10th Street	Seattle	WA	98103		Peggy, Stands, 8901 10th Street, Seattle, WA, 98103				
6	Benjamin	Jones	45 Corning Street	Tulsa	OK	74105		Benjamin, Jones, 45 Corning Street, Tulsa, OK, 74105				

FIGURE 6-10: Using the TEXTJOIN function to create a CSV file for export where fields are separated by commas and records by line breaks. (Sample workbook: TEXTJOIN.xlsx)

After entering the original TEXTJOIN formula in cell H2, I then use the fill handle to copy the formula to the cell range H3:H6. As a result, Excel combines each piece of name and address data into a single, long string of text separated by commas. In cell H4 in Figure 6-10, you can also see the result of setting the *ignore_empty* argument to FALSE the TEXTJOIN function. Because I've told Excel to not ignore empty fields, even though Andrew Miller's street address in cell C4 is missing, the TEXTJOIN function keeps a place for this data in the calculated result in H4 by placing a space followed by a comma immediately following Andrew Miller's name. This is important because the record of the exported CSV file needs to have the same amount of fields to prevent the external database program from putting the city of Boston into the Street field and the state abbreviation of MA into the City field (and so on) in Andrew Miller's record in the resulting database.

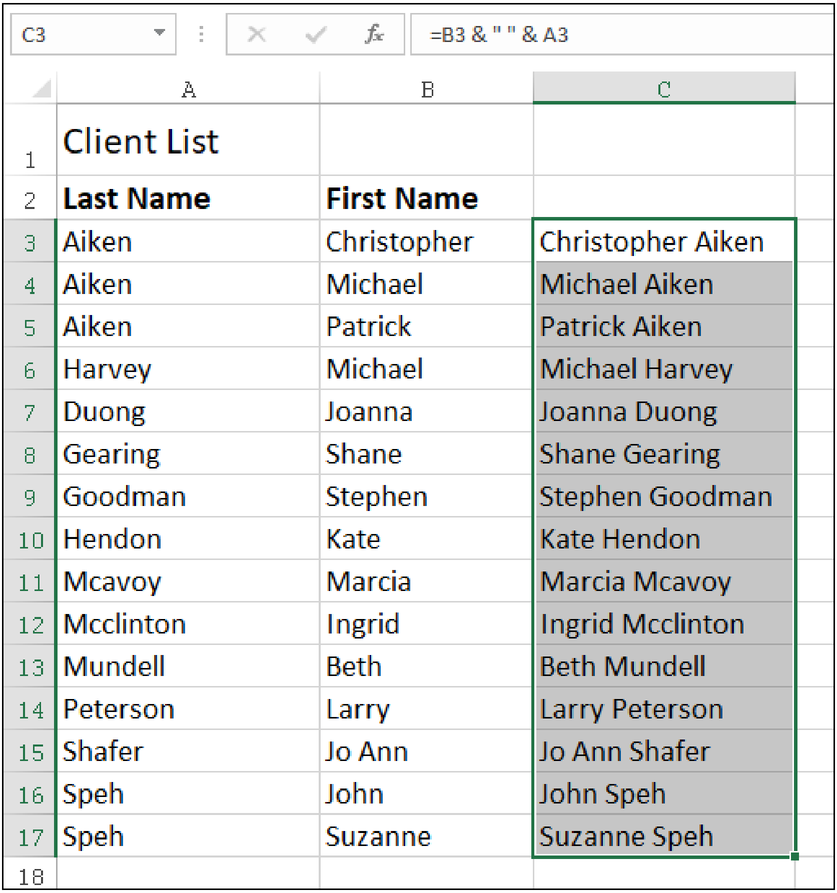
All that's left to do after copying the TEXTJOIN formulas is to copy the values returned by these formulas to the worksheet of a new workbook and then save this new workbook as in the CSV file format. To do this, you follow these steps:

1. **Select the cell range H2:H6 with the TEXTJOIN formulas and press Ctrl+C.**
2. **Open a new workbook file by pressing Ctrl+N.**
3. **Click the Values options on the Paste button's drop-down menu to paste the long comma separated text entries into the cell range A1:A5 in the new workbook (Book 1).**
4. **Save the new workbook file as a CSV file by pressing Ctrl+S, designating the new filename as well as the drive and folder where it's to be saved, clicking CSV (Comma Delimited) from the Save As Type drop-down menu, and clicking the Save button.**

After saving the joined comma separated client address data in the new CSV file, you're ready to send the file to whatever department needs it. (See Book 4, Chapter 3 for more on sharing files.)

Concatenating text

You can use the ampersand (&) operator to concatenate (or join) separate text strings together. For example, in the Client list worksheet shown in Figure 6-9, you can use this operator to join together the first and last names currently entered in two side-by-side cells into a single entry, as shown in Figure 6-11 (sample workbook: Client List.xlsx).



C3

=B3 & " " & A3

	A	B	C
1	Client List		
2	**Last Name**	**First Name**	
3	Aiken	Christopher	Christopher Aiken
4	Aiken	Michael	Michael Aiken
5	Aiken	Patrick	Patrick Aiken
6	Harvey	Michael	Michael Harvey
7	Duong	Joanna	Joanna Duong
8	Gearing	Shane	Shane Gearing
9	Goodman	Stephen	Stephen Goodman
10	Hendon	Kate	Kate Hendon
11	Mcavoy	Marcia	Marcia Mcavoy
12	Mcclinton	Ingrid	Ingrid Mcclinton
13	Mundell	Beth	Beth Mundell
14	Peterson	Larry	Larry Peterson
15	Shafer	Jo Ann	Jo Ann Shafer
16	Speh	John	John Speh
17	Speh	Suzanne	Suzanne Speh
18			

FIGURE 6-11: Worksheet after concatenating the first and last names in column C. (Sample workbook: Client List.xlsx)

To join the first name entry in cell B3 with the last name entry in cell A3, I entered the following formula in cell C3:

```
=B3 & " " & A3
```

Notice the use of the double quotes in this formula. They enclose a blank space that is placed between the first and last names joined to them with the two concatenation operators. If I didn't include this space in the formula and just joined the first and last names together with this formula

```
=B3 & A3
```

Excel would return ChristopherAiken to cell C3, all as one word.

After entering the concatenation formula that joins the first and last names in cell C3 separated by a single space, I then drag the fill handle in cell C3 down to C17 to join all the other client names in a single cell in column C.

After the original concatenation formula is copied down the rows of column C, I copy the selected cell range C3:C17 to the Clipboard by clicking the Copy button in the Clipboard group of the Home tab on the Ribbon, and then I immediately choose the Paste Values option from the Paste command button's drop-down menu. This action pastes calculated text values over the concatenation formulas, thereby replacing the original formulas. The result is a list of first and last names together in the same cell in the range C3:C17, as though I had manually input each one.

Book 4

Worksheet Collaboration and Review

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Chapter 1

Protecting Workbooks and Worksheet Data

IN THIS CHAPTER

- **Assigning a password for opening a workbook**
- **Assigning a password for making editing changes in a workbook**
- **Using the Locked and Hidden protection formats**
- **Protecting a worksheet and selecting what actions are allowed**
- **Enabling cell range editing by particular users in a protected sheet**
- **Doing data entry solely in unlocked cells of a protected worksheet**
- **Protecting the workbook**

Before you start sending your worksheets for review, you need to make them secure. Security in Excel exists on two levels. The first is protecting the workbook file so that only people entrusted with the password can open the file to view, print, or edit the data. The second is protecting the worksheets in a workbook from unwarranted changes so that only people entrusted with that password can make modifications to the worksheet contents and design.

When it comes to securing the integrity of your worksheets, you can decide which aspects of the sheets in the workbook your users can and can't change. For example, you may prevent changes to all formulas and headings in a worksheet, while still enabling users to make entries in the cells referenced in the formulas themselves.

Password-Protecting the Workbook

By password-protecting the workbook, you can prevent unauthorized users from opening the workbook and/or editing the workbook.

You set a password for opening the file when you're dealing with a workbook that contains data of a sufficiently private or sensitive nature that only a certain group of people in the company should have access to it (such as worksheets dealing with personal information and salaries). After you set the password required to open the workbook, you must supply this password to those people who need access to the data.

You set a password for modifying the file when you're dealing with a workbook that contains data that needs to be viewed and printed by different users, none of whom are authorized to make changes to any of the entries. For example, you may assign a password for modifying a workbook before distributing it companywide, after the workbook's been through a complete editing and review cycle and all the suggested changes have been merged. (See Book 4, Chapter 3 for details for how to share your workbooks.)

Protecting the workbook when saving the file

If you're dealing with a workbook that contains private, confidential, or sensitive data and shouldn't be modified by anyone who's not authorized to open it, you need to set both a password for opening and a password for modifying the workbook file. You assign either one or both of these types of passwords to a workbook file at the time you save it by choosing File⇒ Save As (for a local file) or File⇒ Save a Copy (for an online file), or press Alt+FA.

When you choose this command (or, for a new file that's never been saved, click the Save button on the Excel title bar or press Ctrl+S), Excel opens the Save As screen where you select the place where you want to save the file. (See Book 2, Chapter 1 for details.) After you select the place to save the file and assign its filename on the Save As screen, click the More Options link to have Excel open the Save As dialog box where you can then set the password to open and/or the password to modify the file by taking these steps:

1. **Click the Tools button in the Save As dialog box and then choose General Options from its drop-down menu.**

Doing this opens the General Options dialog box, similar to the one shown in Figure 1-1, where you can enter a password to open and/or a password to modify in the File Sharing section.

2. **(Optional) If you want to assign a password to open the file, type the password in the Password to Open text box.**

   Your password can be as long as 255 characters, consisting of a combination of letters and numbers with spaces. When adding letters to your passwords, keep in mind that these passwords are case-sensitive. This means that opensesame and OpenSesame are not the same password because of the different use of upper- and lowercase letters.

   REMEMBER When entering a password, make sure that you don't enter something that you can't easily reproduce or, for heaven's sake, that you can't remember. You must be able to immediately reproduce the password to assign it, and you must be able to reproduce it later if you want to be able to open or change the workbook ever again.

   As you type the password, Excel masks the actual characters you type by rendering them as dots in the text box, as shown in Figure 1-1.

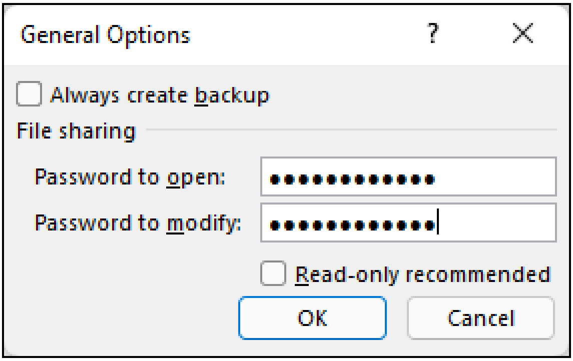
   If you decide to assign a password for opening and modifying the workbook at the same time, proceed to Step 3. Otherwise, skip to Step 4.

   When entering the password for modifying the workbook, you want to assign a password that's different from the one you just assigned for opening the file (if you did assign a password for opening the file in this step).

3. **(Optional) If you want to assign a password for modifying the workbook, type it in the Password to Modify text box.**
4. **Click OK.**

   The Confirm Password dialog box appears.
5. **If you entered a password to open the file, use the Reenter Password to Proceed text box to type the same password as you entered in Step 2, and then click OK.**
6. **If you entered a password to modify the file, use the Reenter Password to Modify text box to type the same password as you entered in Step 3, and then click OK.**
7. **(Optional) If you want to save the password-protected version under a new filename or in a different folder, edit the name in the File Name text box and then select the new folder from the Save In drop-down list.**
8. **Click Save.**

   Excel saves the file if this is the first time you've saved it. If not, the program displays an alert dialog box indicating that the file you're saving already exists and asking you whether you want to replace the existing file.
9. **Click Yes.**



General Options

☐ Always create backup

File sharing

Password to open: ●●●●●●●●●●●●

Password to modify: ●●●●●●●●●●●●

☐ Read-only recommended

FIGURE 1-1: Setting a password to open and modify the workbook in the General Options dialog box.

TIP Select the Read-Only Recommended check box in the General Options dialog box instead of assigning a password for editing the workbook in the Password to Modify text box when you never want the user to be able to make and save changes in the same workbook file. When Excel marks a file as read-only, the user must save any modifications in a different file using the Save As (or Save a Copy) command. (See "Entering the password to make changes" later in this chapter for more on working with a read-only workbook file.)

TIP The last chance you have to password-protect the opening of the file is before you close the file during the work session in which you originally assign the password. If, for whatever reason, you decide that you don't want to go through the hassle of having to reproduce the password each and every time you open this file, you can get rid of it by choosing File⇒ Save As (for a local file) or File⇒ Save a Copy (for an online file), or pressing Alt+FA, clicking More Options, choosing General Options from the Tools drop-down menu, and then deleting the password in the Password to Open text box. Click OK in the General Options dialog box and the Save button in the Save As dialog box. Excel resaves the workbook file without a password to open it so that you don't have to worry about reproducing the password the next time you open the workbook for editing or printing.

Assigning a password to open from the Info screen

Instead of assigning the password to open your workbook at the time you save changes to it, you can do this as well from Excel's Info screen in the Backstage view by following these simple steps:

1. **Choose File⇒ Info or press Alt+FI.**

   Excel opens the Info screen.

2. **Click the Protect Workbook button to open its**

drop-down menu and then choose Encrypt with Password.

Excel opens the Encrypt Document dialog box.

3. **Type the password in the Password text box and then click OK.**

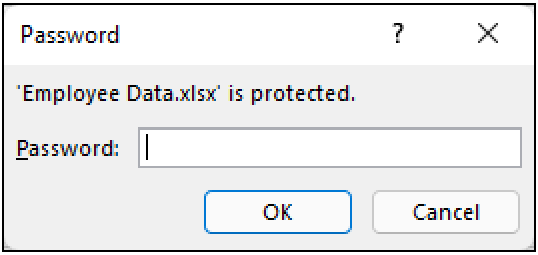
   Excel opens the Confirm Password dialog box.

4. **Type the password in the Reenter Password text box exactly as you typed it into the Password text box in the Encrypt Document dialog box and then click OK.**

REMEMBER The drop-down menu attached to the Protect Workbook button in the Info screen in the Backstage doesn't contain an option for protecting the workbook from further modification after it's opened in Excel. Instead, it contains a Mark as Final option that assigns read-only status to the workbook file that prevents the user from saving changes to the file under the same filename.

Entering the password to gain access

After you close a workbook file to which you've assigned a password for opening it, you must be able to faithfully reproduce the password to open the file (at least until you change or delete the password). When you next try to open the workbook, Excel opens a Password dialog box like the one shown in Figure 1-2, where you must enter the password exactly as it was assigned to the file.



'Employee Data.xlsx' is protected.

FIGURE 1-2: Entering the password required to open a protected workbook file.

WARNING A password-protected workbook file for which you can't reproduce the correct password can be a real nightmare (especially if you're talking about a really important workbook with loads of vital data). So, for heaven's sake, don't forget your password, or you'll be stuck. Excel doesn't provide any sort of command for overriding the password and opening a protected workbook, nor does Microsoft offer any such utility. If you think that you may forget the workbook's password, be sure to write it somewhere and then keep that piece of paper in a secure place, preferably under lock and key. It's always better to be safe than sorry when it comes to passwords for opening files.

Entering the password to make changes

If you've protected your workbook from modifications with the Password to Modify option in the General Options dialog box, as soon as you attempt to open the workbook (and have entered the password to open the file, if one has been assigned), Excel immediately displays the Password dialog box where you must accurately reproduce the password assigned for modifying the file or click the Read Only button to open it as a read-only file.

When you supply the correct password, Excel immediately closes the Password dialog box, and you are free to edit the workbook in any way you wish (unless certain cell ranges or worksheets are protected). If you're unable to successfully reproduce the password, you can click the Read Only command button, which opens a copy of the workbook file into which you can't save your changes unless you choose File⇒ Save As command (or File⇒ Save a Copy) and then rename the workbook and/or locate the copy in a different folder.

When you click the Read Only button, Excel opens the file with a [Read-Only] indicator appended to the filename as it appears on the Excel title bar. If you then try to save changes with the Save button on the Excel title bar or the Save command on the File menu, the program displays an alert dialog box, indicating that the file is read-only and that you must save a copy by renaming the file in the Save As dialog box. As soon as you click OK to clear the alert dialog box, Excel displays the Save As dialog box, where you can save the copy under a new filename and/or location. Note that the program automatically removes the password for modifying from the copy so that you can modify its contents any way you like.

TIP Because password-protecting a workbook against modification doesn't prevent you from opening the workbook and then saving an unprotected version under a new filename with the Save As command, you can assign passwords for modifying files without nearly as much trepidation as assigning them for opening files. Assigning a password for modifying the file assures that you'll always have an intact original of the worksheet from which you can open and save a copy, even if you can never remember the password to modify the original itself.

Changing or deleting a password

Before you can change or delete a password for opening a workbook, you must first be able to supply the current password to get the darned thing open. Assuming you can do this, all you have to do to change or get rid of the password is open the Info screen in the Backstage view (Alt+FI) and then choose the Encrypt with Password option from the Protect Workbook button's drop-down menu.

Excel opens the Encrypt Document dialog box with your password in the Password text box masked by asterisks. To then delete the password, remove all the asterisks from this text box before you click OK.

To reassign the password, replace the current password with the new one you want to assign by typing it over the original one. Then, when you click OK in the Encrypt Document dialog box, re-enter the new password in the Confirm Password dialog box and then click OK. Finally, after closing the Encrypt Document dialog box, you click the Save option on the File menu in the Backstage view to save your changes and return to the regular worksheet window.

REMEMBER To change or delete the password for modifying the workbook, you must do this from the General Options dialog box. Choose File⇒ Save As (for a local file) or File⇒ Save a

Copy (for an online file), press Alt+FA and then, after indicating the place to save the file in the Save As screen, click the More Options link to open the Save As dialog box where you can choose the General Options item from the Tools drop-down menu. You then follow the same steps for changing or deleting the password that's entered into the Password to Modify text box in the General Options dialog box.

Setting Up Worksheet Data Protection

After you have the worksheet the way you want it, you often need the help of Excel's Protection feature to keep it that way. Nothing's worse than having an inexperienced data entry operator doing major damage to the formulas and functions that you've worked so hard to build and validate. To keep the formulas and standard text in a worksheet safe from any unwarranted changes, you need to protect the worksheet.

Before you start using Excel's commands for protecting the worksheet, you need to understand how protection works in Excel. All cells in the workbook are either locked or unlocked for editing and hidden or unhidden for viewing.

When you open a new worksheet, all the cells in the workbook have locked as their editing status and unhidden as their display status. However, these default settings do nothing until you turn on protection with the Protect Sheet and Protect Workbook command buttons on the Review tab. At that time, you're then prevented from making any editing changes to all cells with a locked status and from viewing the contents of all cells on the Formula bar when they contain the cell cursor with a hidden status.

What this means in practice is that, prior to turning on worksheet protection, you go through the worksheet removing the Locked Protection format from all the cell ranges where you or your users need to be able to do data entry and editing even when the worksheet is protected. You also assign the Hidden Protection format to all cell ranges in the worksheet where you don't want the contents of the cell to be displayed when protection is turned on in the worksheet. Then, when that formatting is done, you activate protection for all the remaining locked cells and block the Formula bar display for all the hidden cells in the sheet.

TIP When setting up your own worksheet templates, you will want to unlock all the cells where users need to input new data and keep locked all the cells that contain headings and formulas that never change. You may also want to hide cells with formulas if you're concerned that their display may tempt the users to waste time trying to fiddle with or finesse them. Then, turn on worksheet protection prior to saving the file in the template file format. (See Book 2, Chapter 1, for details.) You are then assured that all worksheets generated from that template automatically inherit the same level and type of protection as you assigned in the original worksheet.

Changing a cell's Locked and Hidden Protection formatting

To remove the Locked protection status from a cell range or nonadjacent selection, use either of the following methods:

- Select the range or ranges to be unlocked; then, in the Home tab's Cells group, click Format and then click to deactivate the Lock Cell option (or press Alt+HOL).
- Select the range or ranges to be unlocked; then, in the Home tab's Cells group, choose Format⇒ Format Cells (or press Ctrl+1 or Alt +HOE) to open the Format Cells dialog box. Click the Protection tab, deselect the Locked check box, and then click OK.

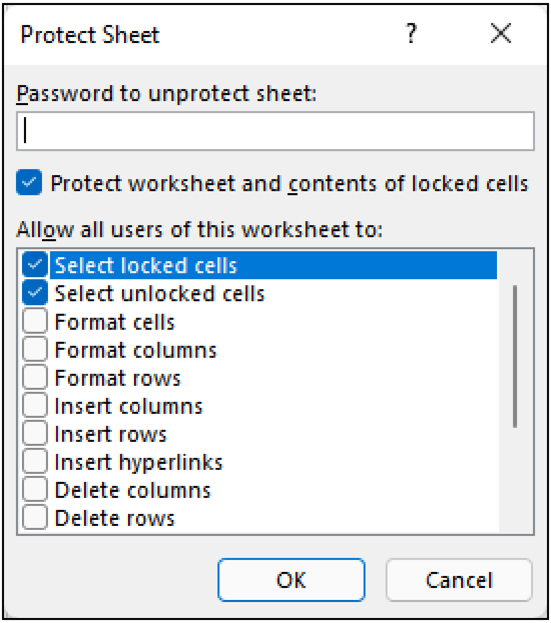
Excel lets you know that the cells that contain formulas in the selected range are no longer locked by adding tiny green triangles to the upper-left corner of each cell in the range that, when clicked, display an alert drop-down button whose tool tip reads, "This cell contains a formula and is not locked to protect it from being changed inadvertently." When you click this alert button, a drop-down menu with Lock Cell as one of its menu items appears. Note that as soon as you turn on protection in the sheet, these indicators disappear.

To hide the display of the contents of the cells in the current selection, in the Home tab's Cells group, choose Format⇒ Format Cells (or press Ctrl+1 or Alt+HOE) to open the Format Cells dialog box. Click the Protection tab, select the Hidden check box, and then click OK.

REMEMBER Changing the protection formatting of cell ranges in the worksheet (as described in this section) does nothing in and of itself. It's not until you turn on the protection for your worksheet (as outlined in the next section) that your unlocked and hidden cells work or appear any differently from the locked and unhidden cells. At that time, only unlocked cells accept edits, and only unhidden cells display their contents on the Formula bar when they contain the cell cursor.

Protecting the worksheet

When you've got all the cells and ranges you want unlocked and hidden correctly formatted in the worksheet, you're ready to turn on protection. To do this, display the Review tab and then, in the Protect group, click the Protect Sheet command (or press Alt+RPS) to open the Protect Sheet dialog box, shown in Figure 1-3.



Password to unprotect sheet:

☑ Protect worksheet and contents of locked cells

Allow all users of this worksheet to:

☑ Select locked cells
☑ Select unlocked cells
☐ Format cells
☐ Format columns
☐ Format rows
☐ Insert columns
☐ Insert rows
☐ Insert hyperlinks
☐ Delete columns
☐ Delete rows

FIGURE 1-3: Use the Protect Sheet dialog box to select your worksheet protection options.

When you first open this dialog box, the Protect Worksheet and

Contents of Locked Cells check box is selected. Also, in the Allow All Users of This Workbook To list, the Select Locked Cells and Select Unlocked Cells check boxes are selected. All the other check boxes are deselected.

This means that if you click OK at this point, the *only* things that you'll be permitted to do in the worksheet are edit *unlocked* cells and select cell ranges (of any type: both locked and unlocked alike).

TIP If you really want to keep other users out of all the locked cells in a worksheet, deselect the Select Locked Cells check box. That way, your users are completely restricted to just those unlocked ranges where you permit data input and content editing.

WARNING Don't, however, deselect both the Select Unlocked Cells check box and the Select Locked Cells check box, because doing this causes the cell pointer to disappear from the worksheet. Without the cell pointer, the cell address in the Formula bar's Name Box becomes the sole way for you and your users to keep track of their position in the worksheet (which is, believe me, the quickest way to drive you and your users stark raving mad).

Selecting what actions are allowed in a protected sheet

Besides enabling users to select locked and unlocked cells in the worksheet, you can enable the following actions in the protected worksheet by selecting their check boxes in the Allow All Users of This Worksheet To list box of the Protect Sheet dialog box:

- **Format Cells:** Enables the formatting of cells (with the exception of changing the locked and hidden status on the Protection tab of the Format Cells dialog box).
- **Format Columns:** Enables formatting so that users can modify the column widths and hide and unhide columns.
- **Format Rows:** Enables formatting so that users can modify the

row heights and hide and unhide rows.

- **Insert Columns:** Enables the insertion of new columns in the worksheet.
- **Insert Rows:** Enables the insertion of new rows in the worksheet.
- **Insert Hyperlinks:** Enables the insertion of new hyperlinks to other documents, both local and on the web. (See Book 2, Chapter 1, for details.)
- **Delete Columns:** Enables the deletion of columns in the worksheet.
- **Delete Rows:** Enables the deletion of rows in the worksheet.
- **Sort:** Enables the sorting of data in unlocked cells in the worksheet. (See Book 6, Chapter 1, for details.)
- **Use AutoFilter:** Enables the filtering of data in the worksheet. (See Book 6, Chapter 2, for more information.)
- **Use PivotTable & PivotChart:** Enables the manipulation of PivotTables and PivotCharts in the worksheet. (For more about PivotTables, see Book 7, Chapter 2.)
- **Edit Objects:** Enables the editing of graphic objects, such as text boxes, embedded images, and the like, in the worksheet. (See Book 5, Chapter 2, for details.)
- **Edit Scenarios:** Enables the editing of what-if scenarios, including modifying and deleting them. (For details of what-if scenarios, see Book 7, Chapter 1.)

Assigning a password to unprotect the sheet

Besides enabling particular actions in the protected worksheet, you can also assign a password that's required to remove the protections from the protected worksheet. When entering a password in the Password to Unprotect Sheet text box of the Protect Sheet dialog box, you observe the same guidelines as when assigning a password to open or to make changes in the workbook. (A maximum of 255 characters that can consist of a combination of letters, numbers, and spaces, with the letters being case-sensitive.)

As with assigning a password to open or make changes to a workbook, when you enter a password (whose characters are masked with asterisks) in the Password to Unprotect Sheet text box and then click OK, Excel displays the Confirm Password dialog box. Here, you must accurately reproduce the password you just entered (including upper-

and lowercase letters) before Excel turns on the sheet protection and assigns the password for removing protection.

Excel closes the Protect Sheet dialog box and enables protection for that sheet, using whatever settings you designated in that dialog box.

WARNING If you don’t assign a password to unprotect the sheet, any user with a modicum of Excel knowledge can lift the worksheet protection and make any manner of changes to its contents, including wreaking havoc on its computational capabilities by corrupting its formulas. Keep in mind that it makes little sense to turn on the protection in a worksheet if you’re going to permit anybody to turn it off by clicking the Unprotect Sheet command button on the Review tab (which automatically replaces the Protect Sheet command button as soon as you turn on protection in the worksheet).

Removing protection from a worksheet

When you assign protection to a sheet, your input and editing are restricted solely to unlocked cells in the worksheet, and you can perform only those additional actions that you enabled in the Allow Users of this Worksheet To list box. If you try to replace, delete, or otherwise modify a locked cell in the protected worksheet, Excel displays an alert dialog box with the following message:

```
The cell or chart you're trying to change is on a protected
sheet.
```

The message then goes on to tell you

```
To make a change, unprotect the sheet. You might be requested
to enter a password.
```

If you’ve assigned a password to unprotect the sheet, when you click the Unprotect Sheet button, the program displays the Unprotect Sheet dialog box, where you must enter the password exactly as you assigned it. As soon as you remove the protection by entering the correct password in this dialog box and clicking OK, Excel turns off the protection in the sheet, and you can once again make any kinds of modifications to its structure and contents in both the locked and unlocked cells.

REMEMBER When you protect a worksheet, only the data and graphics on that particular worksheet are protected. This means that you can modify the data and graphics on other sheets of the same workbook without removing protection. If you have data or graphics on other sheets of the same workbook that also need protecting, you need to activate each sheet and then repeat the entire procedure for protecting it as well (including unlocking cells that need to be edited and selecting which other actions, if any, to enable in the worksheet, and whether to assign a password to unprotect the sheet) before distributing the workbook. When assigning passwords to unprotect the various sheets of the workbook, you may want to stick with a single password rather than have to worry about remembering a different password for each sheet, which is a bit much, don’t you think?

Enabling cell range editing by certain users

In the Review tab's Protect group, you can use the Allow Edit Ranges command to enable the editing of particular ranges in the protected worksheet by certain users. When you use this feature, you give specified users permission to edit particular cell ranges, as long as they can correctly provide the password you assign to that range.

To give access to particular ranges in a protected worksheet, follow these steps:

1. **Choose Review⇒ Allow Edit Ranges (or press Alt +RU1).**

   Note that the Allow Edit Ranges command is disabled if the worksheet is currently protected. In that case, you must remove protection by clicking the Unprotect Sheet command button on the Review tab before you retry Step 1.

   Excel opens the Allow Users to Edit Ranges dialog box, as shown in Figure 1-4.

2. **Click the New button.**

   Doing this opens the New Range dialog box where you give the range a title, define its cell selection, and provide the range password, as shown in Figure 1-5.

3. **If you wish, type a name for the range in the Title text box; otherwise, Excel assigns a name such as Range1, Range2, and so on.**

   Next, you designate the cell range or nonadjacent cell selection to which access is restricted.

4. **Click the Refers to Cells text box and then type the address of the cell range (without removing the = sign) or select the range or ranges in the worksheet.**

   Next, you need to enter a password that's required to access the range. Like all other passwords in Excel, this one can be up to 255 characters long, mixing letters, numbers, and spaces. Pay attention to the use of upper- and lowercase letters because the range password is case-sensitive.

5. **Type the password for accessing the range in the Range Password dialog box.**

   You need to use the Permissions button in the New Range dialog box to open the Permissions dialog box for the range you're setting.

6. **Click the Permissions button in the Range Password dialog box.**

   Next, you need to add the users who are to have access to this range.

7. **Click the Add button in the Permissions dialog box.**

   Excel opens the Select Users or Groups dialog box, where you designate the names of the users to have access to the range.

8. **Click the name of the user in the Enter the Object**

Names to Select list box at the bottom of the Select Users or Groups dialog box. To select multiple users from this list, hold down the Ctrl key as you click each username.

If this list box is empty, click the Advanced button to expand the Select Users or Groups dialog box and then click the Find Now button to locate all users for your location. You can then click the name or Ctrl +click the names you want to add from this list, and then when you click OK, Excel returns you to the original form of the Select Users or Groups dialog box and adds these names to its Enter the Object Names to Select list box.

9. **Click OK in the Select Users or Groups dialog box.**

   Doing this returns you to the Permissions dialog box where the names you've selected are now listed in the Group or User Names list box. Now you need to set the permissions for each user. When you first add users, each one is permitted to edit the range without a password. To restrict the editing to only those who have the range password, you need to click each name and then select the Deny check box.

10. **Click the name of the first user who must know the password and then select the Deny check box in the Permissions For list box.**

    You need to repeat this step for each person in the Group or User Names list box that you want to restrict in this manner. (See Figure 1-6.)

11. **Repeat Step 10 for each user who must know the password and then click OK in the Permissions dialog box.**

    The Windows Security dialog box appears, letting you know that you're setting a deny permission that takes precedence over any allowed entries, so that if the person is a member of two groups, one with an Allow entry and the other with a Deny entry, the deny entry permission rules (meaning that the person has to know the range password).

12. **Click the Yes button in the alert dialog box.**

    Doing this closes this dialog box and returns you to the New Range dialog box.

13. **Click OK in the New Range dialog box.**

    The Confirm Password dialog box opens where you must accurately reproduce the range password.

14. **Type the range password in the Reenter Password to Proceed text box and then click the OK button.**

    Doing this returns you to the Allow Users to Edit Ranges dialog box where the title and cell reference of the new range are displayed in the Ranges Unlocked by a Password When Sheet Is Protected list box, as shown in Figure 1-7.

    If you need to define other ranges available to other users in the worksheet, you can do so by repeating Steps 2 through 14.

    When you finish adding ranges to the Allow Users to Edit Ranges dialog box, you're ready to protect the worksheet. If you want to retain a record of the ranges you've defined, go to Step 15. Otherwise, skip to Step 16.

15. **(Optional) Select the Paste Permissions Information Into a New Workbook check box if you want to create a new workbook that contains all the permissions information.**

    When you select this check box, Excel creates a new workbook whose first worksheet lists all the ranges you've assigned, along with the users who may gain access by providing the range password. You can then save this workbook for your records. Note that the range password isn't listed on this worksheet — if you want to add it, be sure that you password-protect the workbook so that only you can open it.

Now, you're ready to protect the worksheet. If you want to do this from within the Allow Users to Edit Ranges dialog box, you click the Protect Sheet button to open the Protect Sheet dialog box. If you want to protect the worksheet later on, click OK to close the Allow Users to Edit Ranges dialog box and then click the Protect Sheet command button on the Review tab of the Ribbon (or press Alt+RPS) when you're ready to activate the worksheet protection.

16. **Click the Protect Sheet button to protect the worksheet; otherwise, click the OK button to close the Allow Users to Edit Ranges dialog box.**

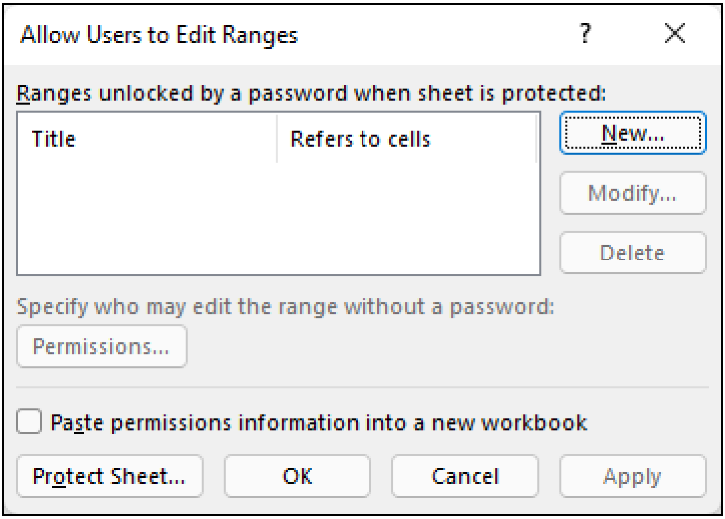

Allow Users to Edit Ranges
?
Ranges unlocked by a password when sheet is protected:
Title
Refers to cells
New...
Modify...
Delete
Specify who may edit the range without a password:
Permissions...
☐ Paste permissions information into a new workbook
Protect Sheet...
OK
Cancel
Apply

FIGURE 1-4: Designating the range to be unlocked by a password in a protected worksheet.

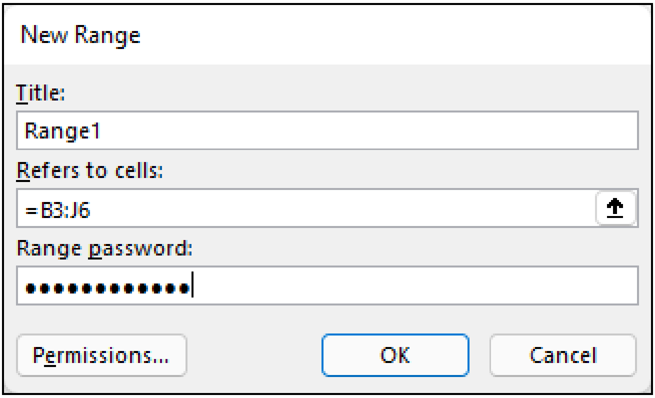
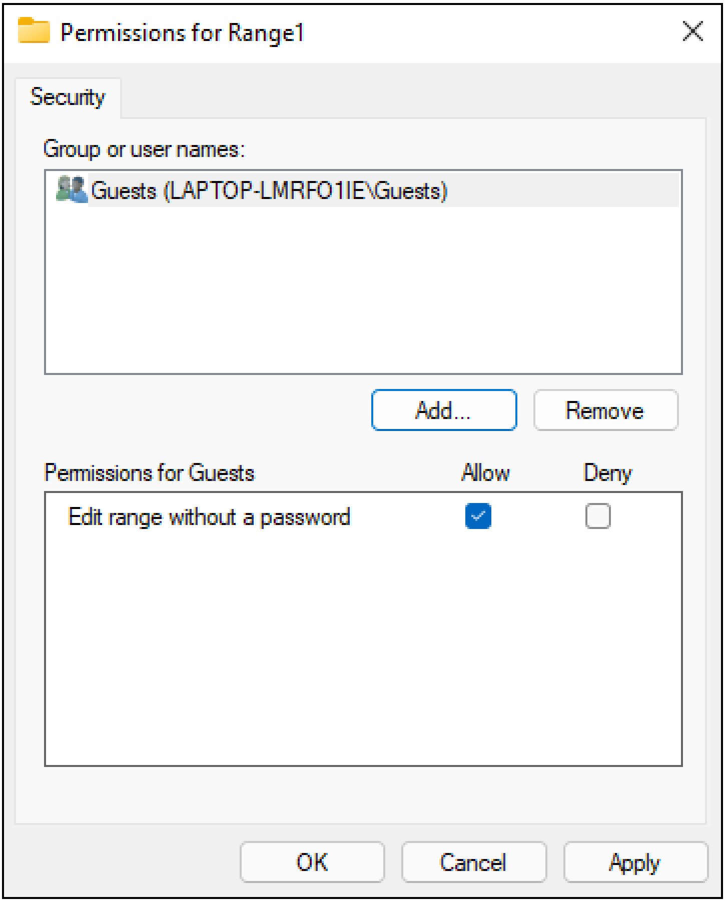

New Range
Title:
Range1
Refers to cells:
=B3:J6
Range password:
●●●●●●●●●●●●
Permissions...
OK
Cancel

FIGURE 1-5: Assigning the range title, address, and password in the New Range dialog box.

If you click the Protect Sheet button, Excel opens the Protect Sheet dialog box, where you can set a password to unprotect the sheet. This dialog box is also where you select the actions that you permit all users to perform in the protected worksheet (as outlined earlier in this chapter).

After you turn on protection in the worksheet, only the users you've designated are able to edit the cell range or ranges you've defined. Of course, you need to supply the range password to all the users allowed to do editing in the range or ranges at the time you distribute the workbook to them.

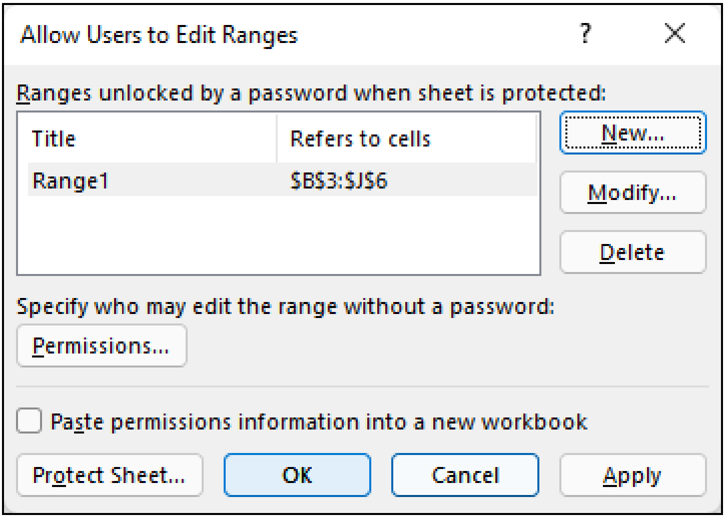

Permissions for Range1
Security
Add...
Remove
OK
Cancel
Apply

Group or user names:

Guests (LAPTOP-LMRFO1IE\Guests)

Permissions for Guests	Allow	Deny
Edit range without a password	☑	☐

FIGURE 1-6: Setting the permissions for each user in the Permissions dialog box.



Ranges unlocked by a password when sheet is protected:

Title	Refers to cells
Range1	$B$3:$J$6

Specify who may edit the range without a password:

☐ Paste permissions information into a new workbook

FIGURE 1-7: Getting ready to protect the sheet in the Allow Users to Edit Ranges dialog box.

TIP

Be sure to assign a password to unprotect the worksheet at the time you protect the worksheet if you want to prevent unauthorized users from being able to make changes to the designated editing ranges in the worksheet. If you don't, any user can make changes by turning off the worksheet protection and thereby gaining access to the Allow Users to Edit Ranges command by clicking the Unprotect Sheet command button on the Review tab of the Ribbon.

Doing data entry in the unlocked cells of a protected worksheet

The best part of protecting a worksheet is that you and your users can jump right to unlocked cells and avoid even dealing with the locked ones (which can't be changed, anyway) by using the Tab and Shift+Tab keys to navigate the worksheet. All you have to do is click the Select Locked Cells check box option to deselect it when you protect the worksheet. (See "Protecting the worksheet" earlier in this chapter.) When you press the Tab key in a protected worksheet when the Select Locked Cells option is turned off, Excel jumps the cell cursor to the next unlocked cell to the right of the current one in that same row. When you reach the last unlocked cell in that row, the program then jumps to the first unlocked cell in the rows below. To move back to a previous unlocked cell, press Shift + Tab. When Excel reaches the last unlocked cell in the worksheet, it automatically jumps back to the very first unlocked cell on the sheet.

You can also press the Enter key to move down the columns instead of across the rows. However, pressing the Enter key to progress down a column selects locked cells in that column as well as the unlocked ones, whereas pressing the Tab key skips all those cells with the Locked protection format.

Figure 1-8 (sample workbook: Spa Holiday Invoice.xltx) illustrates how you can put the Tab key to good use in filling out and navigating a protected worksheet. It shows a worksheet created from a Spa Holiday Hot Tubs invoice template. Because this invoice worksheet in the original template is protected, all worksheets generated from the template are protected as well. The only cells that are unlocked in this sheet are the cells in the following ranges:

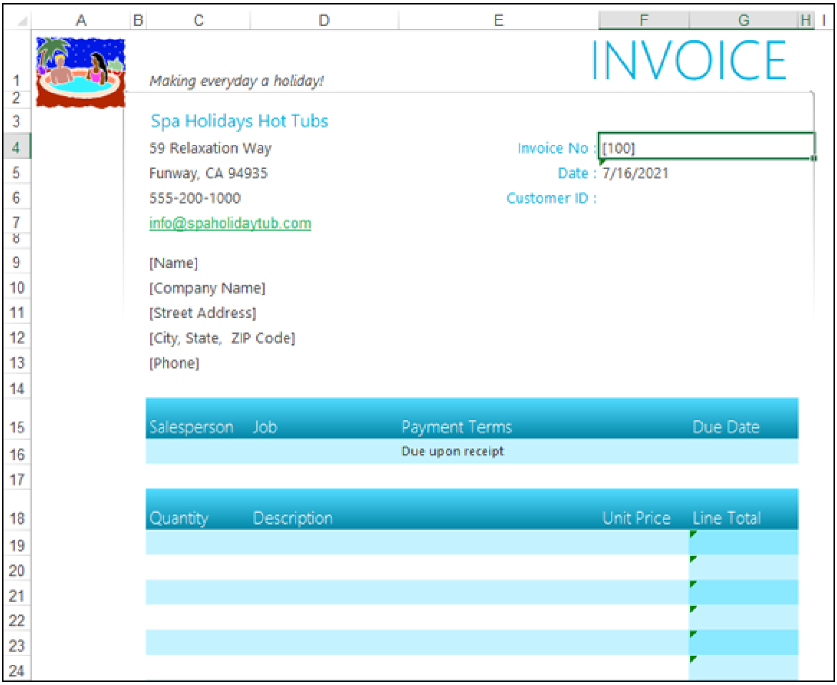
- F4:F6 with the invoice number, date, and customer ID fields
- C9:C13 with the name, company name, street address, city, state and zip, and phone number fields
- C16:D16 with the salesperson and job fields
- Cell G16 with the due date field
- C19:F38 with the quantity, description, and unit price fields

All the rest of the cells in this worksheet are locked and off limits.

To fill in the data for this new invoice, you can press the Tab key to complete the data entry in each field such as Invoice No., Date, Customer ID, Name, Company Name, Street Address, and so on. By pressing Tab, you don't have to waste time moving through the locked cells that contain headings that you can't modify anyway. If you need to back up and return to the previous field in the invoice, just press Shift + Tab to go back to the previous unlocked cell.

TIP

To make it impossible for the user to select anything but the unlocked cells in the protected worksheet, clear the Select Locked Cells check box in the Allow All Users of This Worksheet To list box of the Protect Sheet dialog box.



Making everyday a holiday!

INVOICE

Spa Holidays Hot Tubs
59 Relaxation Way
Funway, CA 94935
555-200-1000
info@spaholidaytub.com

Invoice No : [100]
Date : 7/16/2021
Customer ID :

[Name]
[Company Name]
[Street Address]
[City, State, ZIP Code]
[Phone]

Salesperson	Job	Payment Terms	Due Date
		Due upon receipt	

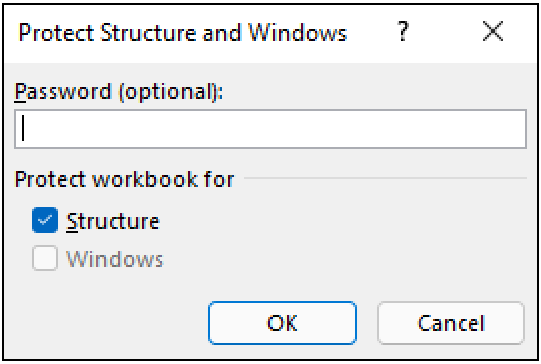
Quantity	Description	Unit Price	Line Total

FIGURE 1-8: Using the Tab key to move from unlocked cell to unlocked cell in a protected worksheet. (Sample workbook: Spa Holiday Invoice.xltx)

Protecting the Workbook Structure

There is one last level of protection that you can apply to your Excel files, and that is protecting the entire workbook. When you protect the workbook, you ensure that its users can't change the structure of the file by adding, deleting, or even moving and renaming any of its worksheets. To protect your workbook, choose Review⇒Protect Workbook (or press Alt+RPW).

Excel displays the Protect Structure and Windows dialog box like the one shown in Figure 1-9. This dialog box contains two check boxes: Structure (which is automatically selected) and Windows (which is disabled because this feature is no longer available). This dialog box also contains a Password (Optional) text box where you can enter a password that must be supplied before you can unprotect the workbook. Like every other password in Excel, the password to unprotect the workbook can be up to 255 characters maximum, consisting of a combination of letters, numbers, and spaces, with all the letters being case-sensitive.



Password (optional):

Protect workbook for

☑ Structure

☐ Windows

FIGURE 1-9: Protecting a workbook in the Protect Structure and Windows dialog box.

When you protect a workbook with the Structure check box selected, Excel prevents you or your users from doing any of the following tasks to the file:

- Inserting new worksheets
- Deleting existing worksheets
- Renaming worksheets
- Hiding or viewing hidden worksheets
- Moving or copying worksheets to another workbook
- Displaying the source data for a cell in a PivotTable or displaying a table's Report Filter fields on separate worksheets (see Book 7, Chapter 2, for details)
- Creating a summary report with the Scenario Manager (see Book 7, Chapter 1, for details)

When you turn on protection for a workbook after selecting the Windows check box in the Protect Structure and Windows dialog box, Excel prevents you from changing the size or position of the workbook's windows (not usually something you need to control).

After you've enabled protection in a workbook, you can then turn it off by choosing the Review tab's Unprotect Workbook command (or by pressing Alt+RPW again). If you've assigned a password to unprotect the workbook, you must accurately reproduce it in the Password text box in the Unprotect Workbook dialog box that then appears.

Chapter 2

Preparing a Workbook for Distribution

IN THIS CHAPTER

- **Checking workbook content and properties**
- **Adding a digital signature**
- **Adding notes to a workbook**
- **Adding ink annotations to a workbook on a touchscreen device**

Given Excel's emphasis on saving your workbooks on your OneDrive in the cloud, it behooves you to be familiar not only with Excel's sharing capabilities (discussed at length in the next chapter), but also with its capabilities for checking compatibility and digitally signing the document before it goes out for review.

In this chapter, you discover how to check your workbook to prepare it for distribution. As part of this process, you may want to just add notes on aspects of the worksheet and suggest possible changes rather than make these changes yourself, or even mark up the worksheet with digital ink if your computer is equipped with a graphics tablet or running Excel on some sort of touchscreen device. In this chapter, you find out how to get your two cents in by annotating a worksheet with text notes that indicate suggested improvements or corrections, as well as highlighting potential change areas with ink.

Getting Your Workbook Ready for Review

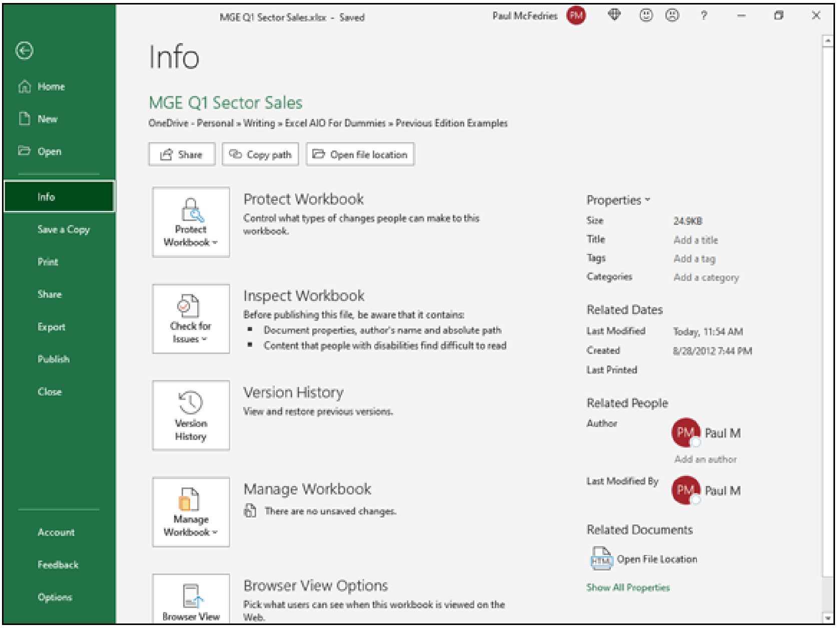
The Info screen in the Excel Backstage view (Alt+FI) shown in Figure 2-1 enables you to prepare your workbook for distribution by inspecting the properties of your workbook. Click the Check for Issues button and then select any of the following options:

- **Inspect Document:** Opens the Document Inspector, which includes several check boxes related to hidden content, workbook metadata (data about the document), personal info, and more. The idea here is that you may want to remove some or all of this potentially sensitive data before you distribute the workbook. Select the check box beside each type of data you want to find, and then click Inspect. Excel scours the workbook and then displays the results. You can delete any not-safe-for-sharing content that Excel finds by clicking that item's Remove All button.
- **Check Accessibility:** Scans the workbook file for information that people with disabilities (particularly, some sort of sight impairment) may have difficulty with. See Book 4, Chapter 3 for a detailed look at Excel accessibility.
- **Check Compatibility:** Checks the workbook file for the following:
    - Features that won't be supported if you open the workbook in an earlier version of Excel.
    - Features that you'll lose if you save the workbook in an older Excel file format.

The Info screen also contains a Manage Workbook button that, when clicked, gives you the following two options for recovering or clearing up draft versions of the workbook so that only the final version is available for sharing:

- **Recover Unsaved Workbooks:** Enables you to browse all the versions of the current workbook that were closed without saving the final changes using Excel's AutoRecover feature. (See Book 2, Chapter 1 for details.)
- **Delete All Unsaved Workbooks:** Tells Excel to remove all the versions of the current workbook that were closed without saving the final changes. (Again, see Book 2, Chapter 1.) If you don't see this command, it means there are no unsaved versions available to delete.

At the very bottom of the Info screen, you find a Browser View Options button that, when clicked, opens the Browser View Options dialog box with two tabs: Show and Parameters. When you want to share the file online, use the Show tab to control what parts of your workbook are displayed; use the Parameters tab to control what named cells can be edited.


MGE Q1 Sector Sales.xlsx - Saved
Paul McFedries
PM
Home
New
Open
Info
Save a Copy
Print
Share
Export
Publish
Close
Account
Feedback
Options
Info
Share
Copy path
Open file location
Protect Workbook
Check for Issues
Version History
Manage Workbook
Browser View

MGE Q1 Sector Sales

OneDrive - Personal » Writing » Excel AIO For Dummies » Previous Edition Examples

Protect Workbook

Control what types of changes people can make to this workbook.

Inspect Workbook

Before publishing this file, be aware that it contains:

- Document properties, author's name and absolute path
- Content that people with disabilities find difficult to read

Version History

View and restore previous versions.

Manage Workbook

There are no unsaved changes.

Browser View Options

Pick what users can see when this workbook is viewed on the Web.

Properties

Size	24.9KB
Title	Add a title
Tags	Add a tag
Categories	Add a category

Related Dates

Last Modified	Today, 11:54 AM
Created	8/28/2012 7:44 PM
Last Printed	

Related People

Author	Paul M Add an author
Last Modified By	Paul M

Related Documents

Open File Location

Show All Properties

FIGURE 2-1: Checking a workbook's properties in its Info screen in the Excel Backstage view.

Adding properties to a workbook

You can add information about your workbook document (called *metadata*) in the Info panel in the Backstage view, using the various fields displayed in its right column (refer to Figure 2-1), which you open by choosing File⇒ Info or pressing Alt+FI. You can then use the metadata that you enter into the Title, Tags, Categories, and Author fields in the Info panel in all the Windows quick searches or file searches you perform. Doing so enables you to quickly locate the file for opening in Excel for further editing and printing or distributing to others to review. When entering more than one piece of data into a particular field such as Title, Tags, or Categories, separate each piece with a comma.

Click the Show All Properties link to add text boxes for additional document metadata fields including Comments, Template, Status, Subject, Hyperlink Base, Company, and Manager.

Digitally signing a document

Excel enables you to add digital signatures to the workbook files that you send for review. After checking the worksheet and verifying its accuracy and readiness for distribution, you can (assuming that you have the authority within your company) digitally sign the workbook in one of two ways:

- Add a visible signature line as a graphic object in the workbook that contains your name, the date of the signing, your title, and, if you have a digital tablet connected to your computer or are running Excel on a touchscreen device, your inked handwritten signature.
- Add an invisible signature to the workbook indicated by the Digital Signature icon on the status bar and metadata added to the document that verifies the source of the workbook.

By adding a digital signature, you warrant the following three things about the Excel workbook you're about to distribute:

- **Authenticity:** The person who signs the Excel workbook is the person they say they are (and not somebody else posing as the signer).
- **Integrity:** The content of the file has not been modified in any way since the workbook was digitally signed.
- **Nonrepudiation:** The signer stands behind the content of the workbook and vouches for its origin.

To make these assurances, the digital signature you add to the workbook must be valid in the following ways:

- The certificate that is associated with the digital signature must be issued to the signing publisher by a reputable certificate authority.
- The certificate must be current and valid.
- The signing publisher must be deemed trustworthy.

REMEMBER Microsoft partners such as Comodo, GlobalSign, and IdenTrust offer digital ID services to which you can subscribe. As reputable certificate authorities, their protection services

> vouch for your trustworthiness as a signing publisher and the currency of the certificates associated with your digital signatures. In addition, they enable you to set the permissions for the workbook that determine who can open the document and how they can use it. To sign up with one of these services, display the Insert tab and then, in the Text group, choose Signature Line⇒ Add Signature Services and then follow the links on the Find Digital ID or Digital Signature Services web page.

To add a digital signature to your finalized workbook, follow these steps:

1. **Inspect the worksheet data, save all final changes in the workbook file, and then position the cell pointer in a blank cell in the vicinity where you want the signature line graphic object to appear.**

   Excel adds the signature line graphic object in the area containing the cell pointer. If you don't move the cell cursor to a blank area, you may have to move the signature line graphic so that the graphic's box doesn't obscure existing worksheet data or other graphics or embedded charts.

2. **In the Insert tab's Text group, choose Signature Line⇒ Microsoft Office Signature Line (or press Alt +NG).**

   Excel displays the Signature Setup dialog box similar to the one shown in Figure 2-2.

3. **Type the signer's name into the Suggested Signer text box and then press Tab.**
4. **Type the signer's title into the Suggested Signer's Title text box and then press Tab.**
5. **Type the signer's e-mail address into the Suggested Signer's E-Mail Address text box.**
6. **(Optional) If needed, edit the default text in the Instructions to this Signer text box.**
7. **(Optional) Select the Allow the Signer to Add Comments in**

the Sign Dialog check box if you want to add your own comments.

8. **(Optional) Deselect the Show Sign Date in Signature Line check box if you don't want the date displayed as part of the digital signature.**
9. **Click OK to close the Signature Setup dialog box.**

   Excel adds a signature line graphic object in the vicinity of the cell cursor with a big X that contains your name and title (shown in Figure 2-3).

10. **Double-click this signature line graphic object or right-click the object and choose Sign.**

    If you don't have a digital ID with one of the subscription services, Excel opens a Get a Digital ID alert dialog box asking you if you want to get one now. Click Yes and then follow the links on the Available Digital IDs web page to subscribe to one.

    Otherwise, Excel opens the Sign dialog box similar to the one shown in Figure 2-3.

11. **Add your signature to the list box containing the insertion point.**

    To add your signature, click the Select Image link on the right, select a graphics file that contains a picture of your handwritten signature in the Select Signature Image dialog box, and then click Select. If you're using a touchscreen device or your computer has a digital tablet connected to it, you add this signature by physically signing your signature with digital ink.

12. **Click the Commitment Type drop-down list box and choose one of the options from its drop-down menu: Created and Approved This Document, Approved This Document, or Created This Document.**

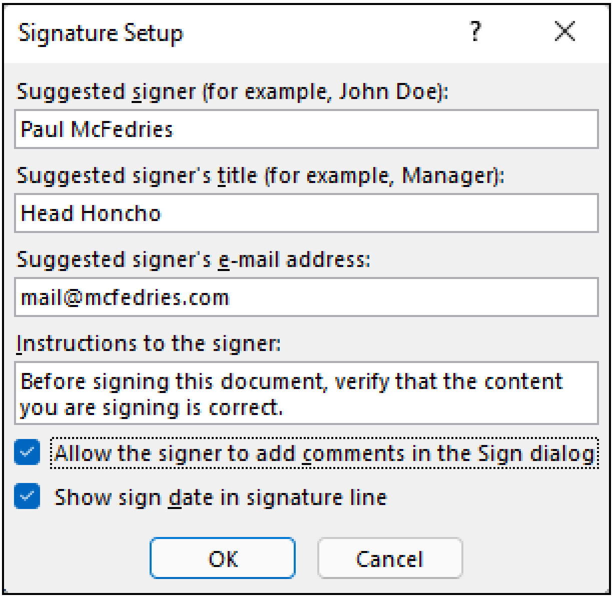
    If you selected the Allow the Signer to Add Comments in the Sign Dialog check box in Step 7, the Sign dialog box contains a Purpose for Signing This Document text box that you fill out in Step 12.

13. **Click the Purpose for Signing This Document text box and then type the reason for digitally signing the workbook.**
14. **(Optional) Click the Details button to open the Additional Signing Information dialog box, where you can add the signer's role and title as well as information on the place where the document was created.**

    By default, Excel issues a digital certificate for the person whose name is entered in the Suggested Signer text box back in Step 3. If you want to use a certificate issued to someone else in the organization, follow Step 15. Otherwise, proceed to Step 16.
15. **(Optional) Click the Change command button to open the Windows Security dialog box, click More Choices, click the name of the person whose certificate you want to use in the list, and then click OK.**
16. **Click the Sign button to close the Sign dialog box.**

    Excel closes the Sign dialog box.

Excel adds your name to the digital signature graphic object and displays the MARKED AS FINAL alert at the top of the worksheet as shown in Figure 2-4.



Suggested signer (for example, John Doe):
Paul McFedries

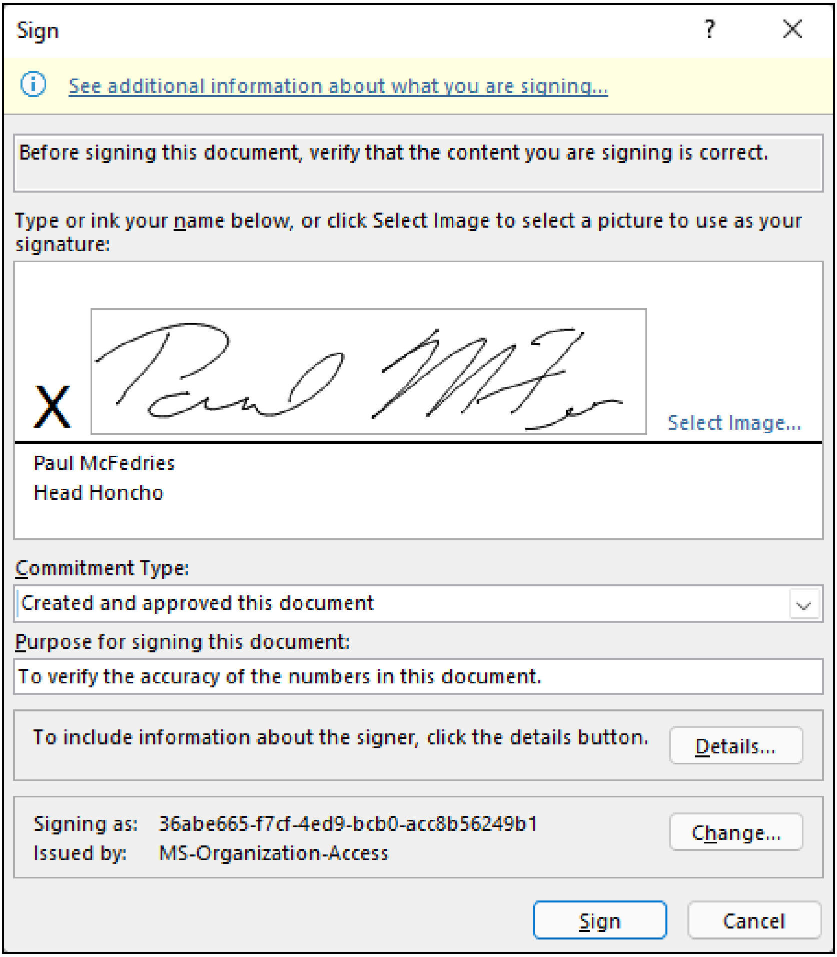
Suggested signer's title (for example, Manager):
Head Honcho

Suggested signer's e-mail address:
mail@mcfedries.com

Instructions to the signer:
Before signing this document, verify that the content you are signing is correct.

☑ Allow the signer to add comments in the Sign dialog
☑ Show sign date in signature line

FIGURE 2-2: Filling out the signing information in the Signature Setup dialog box.



Sign

See additional information about what you are signing...

Before signing this document, verify that the content you are signing is correct.

Type or ink your name below, or click Select Image to select a picture to use as your signature:

X

Paul McFedries
Head Honcho

Commitment Type: Created and approved this document

Purpose for signing this document: To verify the accuracy of the numbers in this document.

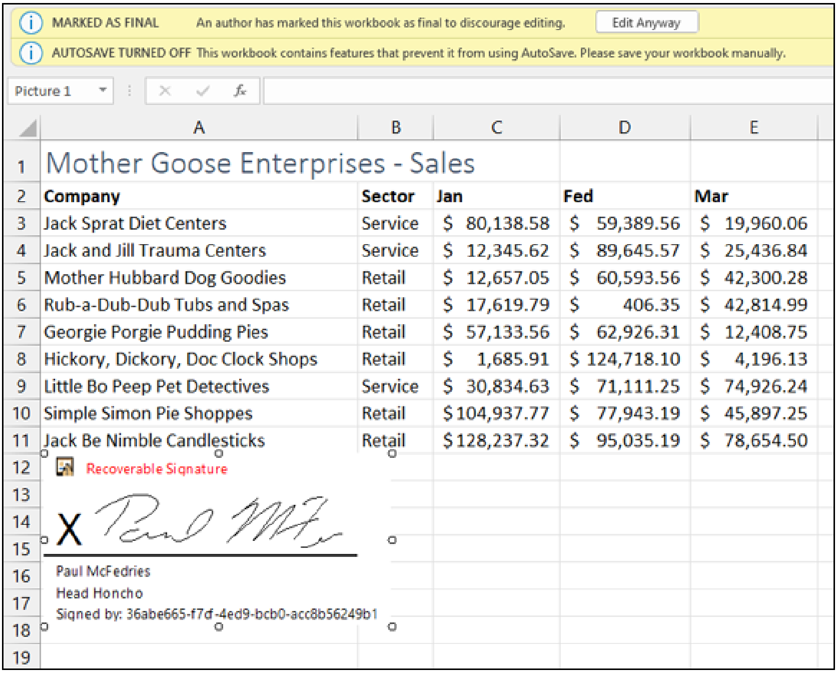
To include information about the signer, click the details button.

Signing as: 36abe665-f7cf-4ed9-bcb0-acc8b56249b1
Issued by: MS-Organization-Access

FIGURE 2-3: Filling in the signature in the Sign dialog box.

TIP

To display all the information about the digital signature added to the workbook, right-click its graphic object and then choose Signature Details from its shortcut menu. To delete a digital signature from a workbook (which you need to do if you discover the sheets in the book require modification), right-click the signature graphic, click Remove Signature, and then click Yes in the Remove Signature dialog box.



MARKED AS FINAL An author has marked this workbook as final to discourage editing.

AUTOSAVE TURNED OFF This workbook contains features that prevent it from using AutoSave. Please save your workbook manually.

	A	B	C	D	E
1	Mother Goose Enterprises - Sales				
2	**Company**	**Sector**	**Jan**	**Fed**	**Mar**
3	Jack Sprat Diet Centers	Service	$ 80,138.58	$ 59,389.56	$ 19,960.06
4	Jack and Jill Trauma Centers	Service	$ 12,345.62	$ 89,645.57	$ 25,436.84
5	Mother Hubbard Dog Goodies	Retail	$ 12,657.05	$ 60,593.56	$ 42,300.28
6	Rub-a-Dub-Dub Tubs and Spas	Retail	$ 17,619.79	$ 406.35	$ 42,814.99
7	Georgie Porgie Pudding Pies	Retail	$ 57,133.56	$ 62,926.31	$ 12,408.75
8	Hickory, Dickory, Doc Clock Shops	Retail	$ 1,685.91	$ 124,718.10	$ 4,196.13
9	Little Bo Peep Pet Detectives	Service	$ 30,834.63	$ 71,111.25	$ 74,926.24
10	Simple Simon Pie Shoppes	Retail	$104,937.77	$ 77,943.19	$ 45,897.25
11	Jack Be Nimble Candlesticks	Retail	$128,237.32	$ 95,035.19	$ 78,654.50

Recoverable Signature

X

Paul McFedries
Head Honcho
Signed by: 36abe665-f7df-4ed9-bcb0-acc8b56249b1

FIGURE 2-4: The workbook after adding the digital signature line graphic with the Signature task pane displayed.

Annotating Workbooks

Even if you don't save your workbooks on a OneDrive or use Excel on a network, you still can annotate your worksheet by adding your notes to the cells of a workbook that ask for clarification or suggest changes, and then you can distribute copies of the workbook by email to other people who need to review and, perhaps, respond to your remarks. Excel makes it easy to annotate the cells of a worksheet, and the Notes command button's options on the Review tab of the Ribbon make it easy to review these notes prior to emailing the workbook to others who have to review the notes, and even reply to suggested changes.

TIP

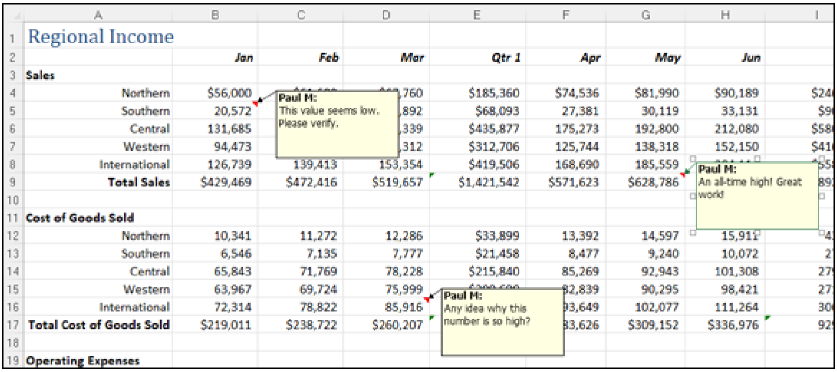
If you're running Excel on a computer equipped with a digital tablet or on a touchscreen device such as a Windows tablet, the Review tab of your Ribbon has a Start Inking command button (not included on this tab when running

Excel on a regular PC). When you click the Start Inking command button, Excel adds an Ink Tools contextual tab to the Ribbon. You can then use the command buttons on its Pens tab to highlight and mark up various parts of the worksheet with digital ink.

Adding notes

You can add a note to the current cell by clicking the Review tab's Notes⇒ New Note command (or by pressing Alt+RTN). Excel responds by adding a Note box similar to the ones shown in Figure 2-5 (sample workbook: Income Analysis.xlsx) with your name listed at the top (or the name of the person who shows up in the User Name text box on the General tab of the Excel Options dialog box). You can then type the text of your note in this box. When you finish typing the text of the note, click the cell to which you're attaching the note or any other cell in the worksheet to close the Note box.

WARNING Don't confuse Notes with Comments on the Review tab. In earlier versions of Excel, notes were called comments. In Excel, comments now refer to threaded comments that you can add to cells of a worksheet to promote a discussion of real or proposed editing changes with other team members with whom you've shared the workbook online (see Book 4, Chapter 3). As with online chats, the comments you post to a worksheet cell as well as responses made to them by other team members appear sequentially in a thread forming the conversation.



	A	B	C	D	E	F	G	H	I
1	Regional Income								
2		*Jan*	*Feb*	*Mar*	*Qtr 1*	*Apr*	*May*	*Jun*	
3	**Sales**								
4	Northern	$56,000		,760	$185,360	$74,536	$81,990	$90,189	$24
5	Southern	20,572		,892	$68,093	27,381	30,119	33,131	$9
6	Central	131,685		,339	$435,877	175,273	192,800	212,080	$58
7	Western	94,473		,312	$312,706	125,744	138,318	152,150	$41
8	International	126,739	139,413	153,354	$419,506	168,690	185,559		
9	**Total Sales**	$429,469	$472,416	$519,657	$1,421,542	$571,623	$628,786		89
10									
11	**Cost of Goods Sold**								
12	Northern	10,341	11,272	12,286	$33,899	13,392	14,597	15,911	4
13	Southern	6,546	7,135	7,777	$21,458	8,477	9,240	10,072	2
14	Central	65,843	71,769	78,228	$215,840	85,269	92,943	101,308	27
15	Western	63,967	69,724	75,999		2,839	90,295	98,421	27
16	International	72,314	78,822	85,916		3,649	102,077	111,264	30
17	**Total Cost of Goods Sold**	$219,011	$238,722	$260,207		3,626	$309,152	$336,976	92
18									
19	**Operating Expenses**								

Paul M:
This value seems low. Please verify.

Paul M:
An all-time high! Great work!

Paul M:
Any idea why this number is so high?

FIGURE 2-5: Adding notes to various cells of a worksheet. (Sample workbook: Income Analysis.xlsx)

Displaying and hiding notes

Excel indicates that you've attached a note to a worksheet cell by adding a red triangle to the cell's upper-right corner. To display the Note box with its text, position the thick, white-cross mouse pointer on this red triangle, or you can click the Review tab's Notes⇒Show All Notes command (Alt+RTS) to display all notes in the worksheet.

When you display a note by positioning the mouse pointer on the cell's red triangle, the note disappears as soon as you move the pointer outside the cell. When you display all the notes on the worksheet by clicking the Review tab's Show All Notes command, you must click the Show All Notes button a second time before Excel closes their Notes boxes (or press Alt+RTS).

Editing and formatting notes

When you first add a note to a cell, its text box appears to the right of the cell with an arrow pointing to the red triangle in the cell's upper-right corner. If you need to, you can reposition a note's text box and/or resize it so that it doesn't obscure certain cells in the immediate region. You can also edit the text of a note and change the formatting of the text font.

To reposition or resize a note's text box or edit the note text or its font, you make the cell current by putting the cell cursor in it and then on the Review tab, click the Edit Note option on the Notes command button's drop-down menu, which replaces the New Note option, or press Alt+RTE. (You can also do this by right-clicking the cell and then choosing Edit Note from the cell's shortcut menu.)

Whichever method you use, Excel then displays the note's text box and positions the insertion point at the end of the note text. To reposition the text box, position the mouse pointer on the edge of the box. When the mouse or Touch pointer assumes the shape of a white arrowhead pointing to a black double-cross, you can then drag the outline of the text box to a new position in the worksheet. After you release the mouse button, Excel draws a new line ending in an arrowhead from the repositioned note text box to the red triangle in the cell's upper-right corner.

When editing and formatting the notes you've added to the worksheet, you can do any of the following:

- To resize the note's text box, you position the mouse pointer on one of the open squares at the corners or in the middle of each edge on the box's perimeter. When the mouse pointer changes into a double-headed arrow, you drag the handle of the text box until its dotted outline is the size and shape you want. (Excel automatically reflows the note text to suit the new size and shape of the box.)
- To edit the text of the note (when the insertion point is positioned somewhere in it), drag the I-beam mouse pointer through text that needs to be replaced or press the Backspace key (to remove characters to the left of the insertion point) or Delete key (to remove characters to the right). You can insert new characters in the note to the right of the insertion point by typing them.
- To change the formatting of the note text, select the text by dragging the I-beam mouse pointer through it and then click the appropriate command button in the Font and Alignment groups on the Home tab of the Ribbon. (You can use Live Preview to see how a new font or font size, on its respective drop-down menu, looks in the note, provided that these drop-down menus don't cover the Note box in the worksheet.)

REMEMBER You can also right-click the text and choose Format Comment from the shortcut menu. Doing this opens the Format Comment dialog box (with the same options as the Font tab of the Format Cells dialog box) where you can change the font, font style, font size, font color, or add special effects including underlining, strike-through, as well as super- and subscripting.

When you finish making your changes to the note's text box and text, close the Note box by clicking its cell or any of the other cells in the worksheet.

Deleting notes

When you no longer need a note, you can delete it by selecting its cell before you do either of the following:

- In the Home tab's Editing group, choose Clear Clear Comments and Notes (or press Alt+HEM).
- Right-click the cell and then choose Delete Note from its shortcut

menu.

Marking up a worksheet with digital ink

TIP If you’re running Excel with a computer connected to a digital tablet or on a touchscreen, you can mark up your worksheets with digital ink using the commands on the Draw tab of the Ribbon. (The Draw tab is automatically added when running Excel on a device with a touch-sensitive display screen.)

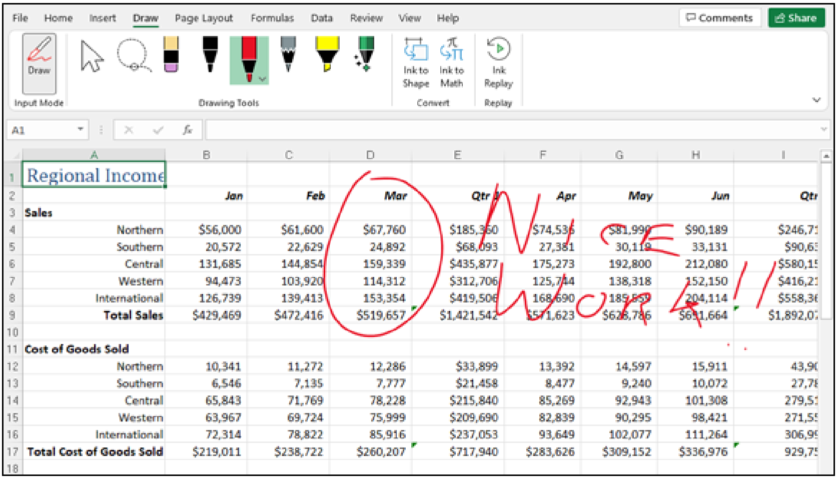
By default, Excel chooses the felt tip pen as the pen type for annotating the worksheet with digital ink. If you’d prefer to use a ballpoint pen or highlighter in marking up the worksheet, tap the Drawing Tools group’s Pen, Pencil, or Highlighter command. If you don’t have a stylus or digital pen available, tap the Draw with Touch command button on the Draw tab and then use your finger to make the pen, pencil, or highlighter ink annotations.

When using the highlighter or either of the two pen types (felt tip or ballpoint pen), you can click the pen’s drop-down arrow to select a new line weight for the ink by choosing the point size (running from 3/4 all the way up to 6 points) from the Thickness section of the drop-down menu. You can also select a new ink color (yellow being the default color for the highlighter, red for the felt tip pen, and black for ballpoint pen) by selecting its color swatch in the Colors section of the drop-down menu.

After you select the pen nib, color, and line weight, you can use your finger or the stylus that comes with your digital tablet to mark up the worksheet as follows:

- To highlight data in the worksheet with the highlighter, drag the highlight mouse pointer through the cells (just as though you had an actual yellow highlighter in your hand).
- To circle data in the worksheet with the felt tip pen, drag the pen tip mouse pointer around the cells in the worksheet.
- To add a note with the ballpoint pen, drag the pen tip mouse pointer to write your text in the worksheet.

Figure 2-6 (sample workbook: Income Analysis.xlsx) shows a copy of the Income Analysis worksheet after I used the Pen: Red command in the Pens group of the Draw tab to draw an oval around the range D2:D9 and write the text "Nice Work!!" in digital ink.



	A	B	C	D	E	F	G	H	I
1	Regional Income								
2		Jan	Feb	Mar	Qtr 1	Apr	May	Jun	Qtr
3	Sales								
4	Northern	$56,000	$61,600	$67,760	$185,360	$74,536	$81,990	$90,189	$246,71
5	Southern	20,572	22,629	24,892	$68,093	27,381	30,119	33,131	$90,63
6	Central	131,685	144,854	159,339	$435,877	175,273	192,800	212,080	$580,15
7	Western	94,473	103,920	114,312	$312,706	125,744	138,318	152,150	$416,21
8	International	126,739	139,413	153,354	$419,506	168,690	185,559	204,114	$558,36
9	Total Sales	$429,469	$472,416	$519,657	$1,421,542	$571,623	$628,786	$691,664	$1,892,07
10									
11	Cost of Goods Sold								
12	Northern	10,341	11,272	12,286	$33,899	13,392	14,597	15,911	43,90
13	Southern	6,546	7,135	7,777	$21,458	8,477	9,240	10,072	27,78
14	Central	65,843	71,769	78,228	$215,840	85,269	92,943	101,308	279,51
15	Western	63,967	69,724	75,999	$209,690	82,839	90,295	98,421	271,55
16	International	72,314	78,822	85,916	$237,053	93,649	102,077	111,264	306,99
17	Total Cost of Goods Sold	$219,011	$238,722	$260,207	$717,940	$283,626	$309,152	$336,976	929,75
18									

FIGURE 2-6: Adding inked notes to a worksheet with my finger on a Windows tablet. (Sample workbook: Income Analysis.xlsx)

If you make a mistake with ink, you need to remove it and start over again. To delete the ink, select the Drawing Tools group's Eraser tool and then tap somewhere on the highlighting, drawing, or handwriting you want to erase with the eraser mouse pointer. (Sometimes you have to drag through the ink to completely remove it.) Then, reselect the highlighter or felt tip or ballpoint pen and reapply your ink annotation.

TIP

In the Review tab's Ink group, tap the Hide Ink command button on the Review tab (Alt+RH2H) to hide and redisplay the inked comments that you've added to your worksheet. The first time you tap this menu option when the inked comments you've added are displayed onscreen, Excel hides them. Tap the Hide Ink option again when you want all your inked comments redisplayed in the worksheet.

TIP In the Draw tab's Replay group, tap the Ink Replay command (or press Alt+JIK) to have Excel play back the individual strokes of all the digital inking you've done to the current worksheet as a quick video. You can tap the Rewind and Forward buttons on the video playback controls that appear at the bottom of the Excel worksheet display when you select the Ink Replay button to remove and rebuild your ink strokes one at a time. You can even drag the Rewind/Forward button (the solid circle) in the playback controls to manually scrub through your ink strokes. When you're finished replaying the inked comments, tap the Ink Replay button again to remove the playback controls and deselect this command button.

WARNING Note that for the Ink Replay command on the Draw tab to work, the inked notes you've added to the worksheet must be displayed in the Excel worksheet area at the time you tap it and not be hidden with the Hide Ink option on the Hide Ink command button's drop-down menu on the Review tab.

After marking a workbook up with your notes, you can then share it with clients or coworkers either by sending an email message inviting them to review the workbook or actually sending them a copy as an email attachment. (See Book 4, Chapter 3 for details.)

Chapter 3

Sharing Workbooks and Worksheet Data

IN THIS CHAPTER

- **Co-authoring workbooks by sharing them with coworkers**
- **Sending worksheets as PDF files for review and comments**
- **Editing Excel worksheets with Excel Online**
- **Sharing Excel data with other Office programs**
- **Inserting Excel data into Word and PowerPoint documents**
- **Making sure your shared workbooks are accessible**
- **Exporting workbooks as PDF, XPS, and HTML (web page) files**
- **Exchanging comments with collaborators**

Sharing data between Excel and other Windows programs that you use is the topic of this chapter. Perhaps the most straightforward way to share worksheet data is by sharing an Excel workbook saved in the cloud on your OneDrive, on your SharePoint team site, or in a folder in your Dropbox. This co-authoring sharing process enables you and those with whom you share your workbook to see all the editing changes made and saved (automatically with the AutoSave feature) to it in real time.

In other cases, data sharing involves getting the Excel data stored in ranges, tables, and charts into other Office programs that you use, especially Microsoft Word documents and PowerPoint presentations. In other cases, data sharing involves getting data generated in other programs, such as in tables created in Microsoft Word and contacts maintained in Microsoft Outlook, into an Excel worksheet.

Finally, you can give people access to worksheet data using programs other than Excel, including Acrobat Reader, the XML Paper Specification Viewer, and their own web browsers by saving the workbook in a special PDF, XPS, or HTML file format.

Sharing Your Workbooks Online

Excel enables you to share your workbooks with trusted clients and coworkers. With Excel's Share feature, you can send someone a link to an online workbook. You can also copy a link to an online workbook and then send the link via a service such as instant message or Microsoft Teams Chat.

For a workbook file saved on your OneDrive or SharePoint site, you can configure the sharing link to allow editing, which means that you and your collaborators can edit the workbook contents simultaneously with Excel on your own devices (or, if they don't have Excel, in their web browsers with the Excel Online web app). This process, referred to as co-authoring, enables you to see all the people with whom you've shared a workbook as well as all the editing changes they make to it as soon as the AutoSave feature saves the changes to the file.

Sharing a workbook saved on your OneDrive

To share an Excel workbook from your OneDrive, follow these steps:

1. **Open the OneDrive workbook file you want to share.**
2. **Either click the Share button near the upper-right corner of the window (or press Alt+ZS) or choose File⇒ Share (or press Alt+FZ).**

   Excel opens the Send Link dialog box, shown in Figure 3-1.
3. **(Optional) Click the Anyone with the Link Can Edit button.**

   Excel opens the Link Settings dialog box, shown in Figure 3-2.
4. **Configure the sharing settings.**

   By default, Excel allows the people with whom you share your workbooks to make editing changes to the workbook that are automatically saved on your OneDrive. If you want to restrict your recipients to reviewing the data without being able to make changes, deselect the Allow Editing check box.

If you wish to set an expiration date after which the sharing link is no longer operational, click the Set Expiration Date button to open the pop-up calendar where you select an expiration date by clicking it in the calendar.

To protect the shared workbook with a password, enter the password in the Set Password text box.

5. **When you're done with the Link Settings dialog box, click Apply to put your new settings into effect and return to the Send Link dialog box.**
6. **In the To text box, begin typing the email address of the first person with whom you want to share the workbook.**

   As you type, Excel matches the letters with the names and email addresses entered in your Address book. When it finds possible matches, they are displayed below the input text box, and you can select the person’s email address by clicking the button with their name. If the recipient is not in your Address book, just type that person's email address.
7. **(Optional) Click the Message text box and type a personal message that you want to incorporate as part of the email invitation to share the file.**

   Otherwise, Excel creates a generic invitation.
8. **Click Send.**

   Excel emails the invitation to share the workbook to each of the recipients entered in the To text box.

All the people with whom you share a workbook receive an email containing a hyperlink to the workbook on your OneDrive. When they follow this link (and sign into the site if this is required), a copy of the workbook opens on a new tab in their default web browser using the Excel Online web app. The web app contains a Mode drop-down button.

When a coworker with whom you’ve shared the workbook clicks the Mode button in Excel Online, they see a menu with the following choices:

- **Viewing:** The user can only examine the workbook; they can't make any changes.
- **Editing:** The user can make changes to the workbook. Users don't see this option if you shared the workbook with editing disallowed.
- **Open in Desktop App:** Opens the workbook in the desktop version of Excel.

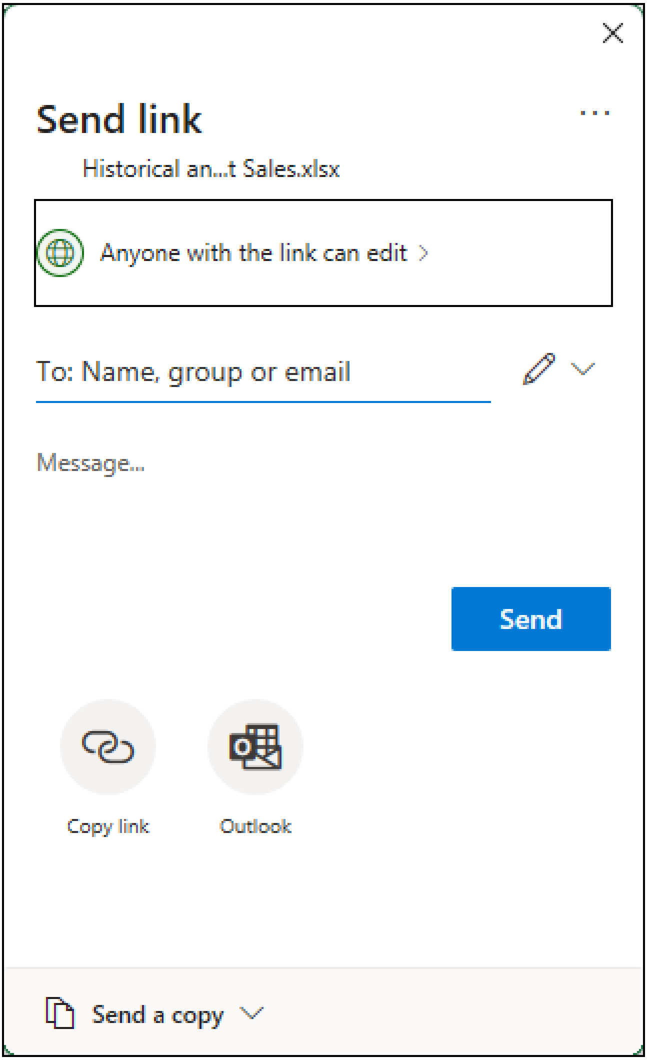
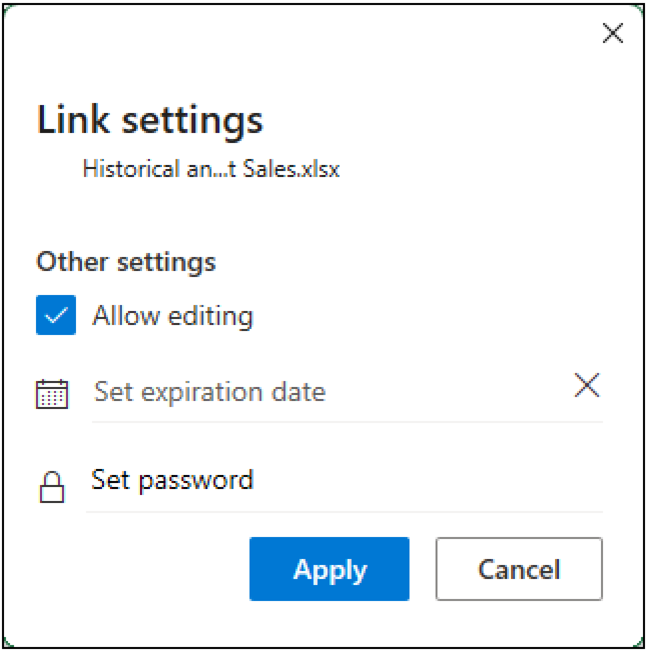

Send link
Historical an...t Sales.xlsx
Anyone with the link can edit
To: Name, group or email
Message...
Send
Copy link
Outlook
Send a copy

FIGURE 3-1: Use the Send Link dialog box to invite coworkers or clients to share an Excel workbook saved on OneDrive.



Link settings

Historical an...t Sales.xlsx

Other settings

☑ Allow editing

Set expiration date

Set password

FIGURE 3-2: Use the Link Settings dialog box to customize the link you're sharing.

While sharing a workbook with the default Anyone Can Edit option, all changes made by the people with whom you've shared the workbook are automatically saved by the AutoSave feature. If you happen to have the workbook open in Excel on your computer with the same worksheet displayed, other users' editing changes automatically appear in your worksheet (in as close to real time as the speed of your Internet access provides). Likewise, all the editing changes that you make to the workbook in Excel are automatically updated in their workbooks in Excel Online. Microsoft refers to this process as co-authoring.

TIP

If a questionable editing change appears in your worksheet when co-authoring with a coworker, you can start a comment thread (Review⇒ New Comment) that communicates your reservations about the change they made. A comment marker appears in the upper-right corner of the cell where you made the comment in the user's worksheet in Excel Online. When the coworker clicks this balloon, Excel Online displays the text of your comment calling into question their edit in a

Comments task pane. They can then reply to your reservations by typing their explanation for the change in the same comment (or in the Comments task pane) and then updating it in your workbook by clicking the Post button. See the last section in this chapter, "Collaborating Conversationally with Comments," about working with comment threads.

Copying a sharing link

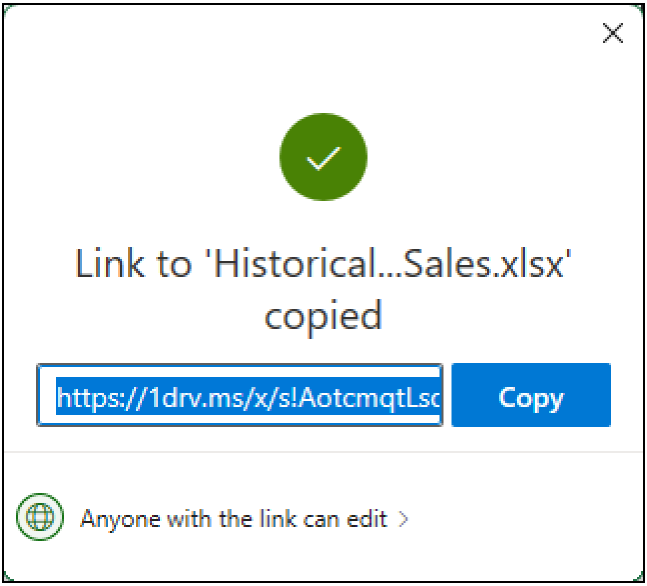
Excel's default sharing method — the Send Link dialog box — sends to each recipient an email invitation with a link to the OneDrive workbook you want to co-author with the invitees. However, these days there are many other ways to exchange information: text, social media direct messages, the Chat feature of a program such as Microsoft Teams or Zoom, and so on. If you'd rather use something other than email to invite your collaborators, you can have Excel create a link to a OneDrive workbook. You can then copy that link address and paste it in whatever app or service you want to use to send the invitation to all the people who require online review and/or editing access.

To copy and send a link to an online workbook, follow these steps:

1. **Open the OneDrive workbook file you want to share.**
2. **Either click the Share button near the upper-right corner of the window (or press Alt+ZS) or choose File⇒ Share (or press Alt+FZ).**

   Excel opens the Send Link dialog box, shown earlier in Figure 3-1.
3. **(Optional) To customize the link sharing, click Anyone with the Link Can Edit to open the Link Settings dialog box (refer to Figure 3-2), make your changes, and then click Apply.**
4. **Click Copy Link.**

   Excel creates a link to the workbook, copies the link to the Clipboard, and then displays a dialog box similar to the one shown in Figure 3-3.
5. **Click Close (X).**
6. **Paste the copied link into the app or service you want to use to invite your collaborators.**


Link to 'Historical...Sales.xlsx' copied

https://1drv.ms/x/s!AotcmqtLsc

FIGURE 3-3: When you click Copy Link, Excel copies the link address to the Clipboard and then displays this dialog box.

Sharing Your Workbooks via Email

Excel enables you to share your workbooks via email with trusted clients and coworkers. With Excel's Share feature, you can send your collaborators a copy of the workbook, either as an Excel file or as a PDF.

Emailing a copy of a workbook

To email a copy of a workbook you have open in Excel to a client or coworker, follow these steps:

1. **Open the OneDrive workbook file you want to share.**
2. **Either click the Share button near the upper-right corner of the window (or press Alt + ZS) or choose File⇒ Share (or press Alt + FZ).**

   Excel opens the Send Link dialog box, shown earlier in Figure 3-1.
3. **Choose Send a Copy⇒ Excel Workbook.**

Outlook creates a new email message with your workbook included as a file attachment.

4. **Address the message, add a subject, and type a message to your recipients.**
5. **Click Send.**

   Excel emails the workbook to each of the recipients.

Emailing a workbook as a PDF file

Sometimes you may need to share workbooks with clients or coworkers who have no knowledge of using Excel but who, nonetheless, need to give you feedback about their worksheet data. For those situations, you can have Excel convert the workbook file into a PDF that's then sent as an email attachment. Your recipients can then review and comment on the workbook contents using a copy of the Adobe Acrobat software (or any other app that can read the PDF file format) on their computer. After making their comments in the PDF, they can share or send a copy of it in PDF format or even convert it into an Excel file so you can then accordingly make whatever changes are necessary in the Excel workbook itself.

To send your Excel workbook file as a PDF, follow these steps:

1. **Open the workbook file that contains the worksheet(s) you want converted to PDF and sent for comments in Excel.**
2. **Either click the Share button near the upper-right corner of the window (or press Alt+ZS) or choose File⇒ Share (or press Alt+FZ).**

   Excel opens the Send Link dialog box, shown earlier in Figure 3-1.

3. **Choose Send a Copy⇒ PDF.**

   Outlook creates a new email message with a PDF conversion of your workbook included as a file attachment.

4. **Address the message, add a subject, and type a message to your recipients.**
5. **Click Send.**

Excel emails the PDF to each of the recipients.

After making their comments directly in the PDF file, your coworkers can save their edits and then either send them to you in PDF form as an email attachment or first convert the annotated PDF file into an Excel workbook file and send that file as an email attachment that can open directly in Excel.

REMEMBER If you receive an email with an annotated PDF file attached to it, open it in your copy of Adobe Acrobat and then choose Tools⇒ Export PDF⇒ Spreadsheet⇒ Microsoft Excel Workbook to convert the annotated PDF file into an Excel workbook file for opening in Excel.

Sharing Excel Data with Office Programs

You share information between Excel and other programs in two ways: You copy or move discrete objects or blocks of data from one program's file to another, or you open an entire file created with one program in the other program.

The key to sharing blocks of data or discrete objects in Excel is the Windows Clipboard. Remember that Excel always gives you access to the contents of the Clipboard in the form of the Clipboard task pane, which you can open by clicking the dialog box launcher in the lower-right corner of the Home tab's Clipboard group. When the Clipboard task pane is open, you can then copy a Clipboard item — such as an object or block of text — into a cell of the open worksheet by clicking the item.

Because very few people purchase Excel as a separate program outside the Microsoft Office suite, it should be no surprise that most of the file sharing happens between Excel and one of the other major applications included in Microsoft Office (particularly Word and PowerPoint).

However, before you rush off and start wildly throwing Excel worksheets into Word documents and Excel charts into PowerPoint presentations, you need to realize that Microsoft offers you a choice in the way that you exchange data between your various Office programs. You can either embed the worksheet or chart in the other program or set up a link between the Excel-generated object in the other program and Excel itself.

- **Embedding** means that the Excel object (whether it's a worksheet or a chart) actually becomes part of the Word document or PowerPoint presentation. Any changes that you then need to make to the worksheet or chart must be made within the Word document or PowerPoint presentation. This presupposes, however, that you have Excel on the same device as Word or PowerPoint and that that device has sufficient memory to run them both.
- **Linking** means that the Excel object (worksheet or chart) is only referenced in the Word document or PowerPoint presentation. Any changes that you make to the worksheet or chart must be made in Excel itself and then updated when you open the Word document or PowerPoint presentation to which it is linked.

Use the embedding method when the Excel object (worksheet or chart) is not apt to change very often, if at all. Use the linking method when the Excel object (worksheet or chart) changes fairly often, when you always need the latest version of the object to appear in your Word document or PowerPoint presentation, or when you don't want to make the Word or PowerPoint document any bigger by adding the Excel data to it.

REMEMBER Be aware that when you link an Excel worksheet or chart to another Office document and you want to show or print that document on a different device, you must copy both the Excel workbook with the linked worksheet/chart and the Word or PowerPoint file to it. Also be aware that when you embed an Excel worksheet or a chart in another Office document and then want to edit it on another device, that device must have both Excel and the other Microsoft Office program (Word or PowerPoint) installed on it.

Use the embedding or linking techniques only when you have a pretty good suspicion that the Excel stuff is far from final and that you want to be able to update the Excel data either manually (with embedding) or automatically (with linking). If your Excel stuff will remain unchanged, just use the old standby method of copying the Excel data to the Clipboard by choosing Home⇒ Copy (or pressing Ctrl+C) and then switching to the Word or PowerPoint document and pasting it in place by choosing Home⇒ Paste (or pressing Ctrl+V).

TIP Excel maintains a very close relationship with Microsoft Access, thus making it easy to import data from any of the tables or queries set up for a database into your Excel worksheet. For details on how to bring in data from Access, see Book 6, Chapter 2.

Sharing data between Excel and Word

Of all the Office programs (besides our beloved Excel), Microsoft Word is the one that you are most apt to use. You will probably find yourself using Word to type any memos, letters, and reports that you need in the course of your daily work. From time to time, you may need to bring some worksheet data or charts that you've created in your Excel workbooks into a Word document. When those occasions arise, check out the information in the next section.

Although Word has a Table feature that supports calculations through a kind of mini-worksheet operation, you'll probably be more productive if you create the data (formulas, formatting, and all) in an Excel workbook and then bring that data into your Word document by following the steps outlined in the next section. Likewise, although you can keep, create, and manage the data records that you use in mail merge operations within Word, you probably will find it more expedient to create and maintain them in Excel — considering that you are already familiar with how to create, sort, and filter database records in Excel.

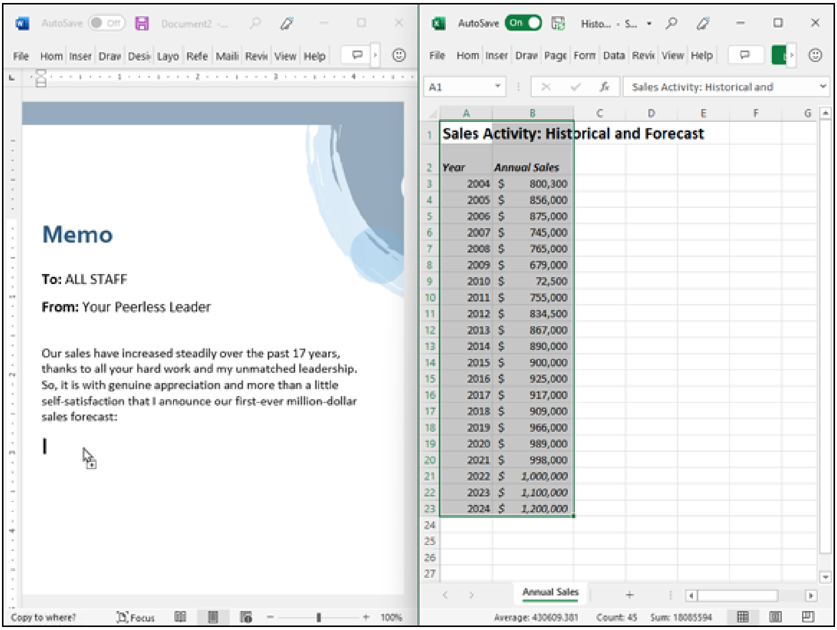
Getting Excel data into a Word document

As with all the other Office programs, you have two choices when bringing Excel data (worksheet cell data or charts) into a Word document: You can embed the data in the Word document, or you can link the data that you bring into Word to its original Excel worksheet. Embed the data or charts when you want to be able to edit right within Word. Link the data or charts when you want to be able to edit in Excel and have the changes automatically updated when you open the Word document.

Happily embedded after

The easiest way to embed a range of worksheet data or a chart is to use the good old drag-and-drop method: Drag the selected cells or chart between the Excel and Word program windows instead of to a new place in a worksheet. The only trick to dragging and dropping between programs is the sizing and maneuvering of the Excel and Word program windows themselves. Figures 3-4 (sample workbook: Historical and Forecast Sales.xlsx) and 3-5 illustrate the method for dragging a table of worksheet data with the 2004 to 2024 historical and forecasted annual sales activity from its worksheet (named Annual Sales) into a new Sales memo document in Word.

In Figure 3-4, you can see that the Excel window is positioned to the immediate right of the Word window. At that point, I had only to select the worksheet data in the Excel worksheet and then hold down the Ctrl key (to copy) as I dragged the outline over to the new paragraph marker in the memo in the Word document window.



AutoSave Off
Document2
File
Hom
Inser
Draw
Desi
Layo
Refe
Maili
Revi
View
Help
AutoSave On
Histo... • S...
File
Hom
Inser
Draw
Page
Form
Data
Revi
View
Help
A1
Sales Activity: Historical and
Annual Sales
Copy to where?
Focus
100%
Average: 430609.381
Count: 45
Sum: 18085594

Memo

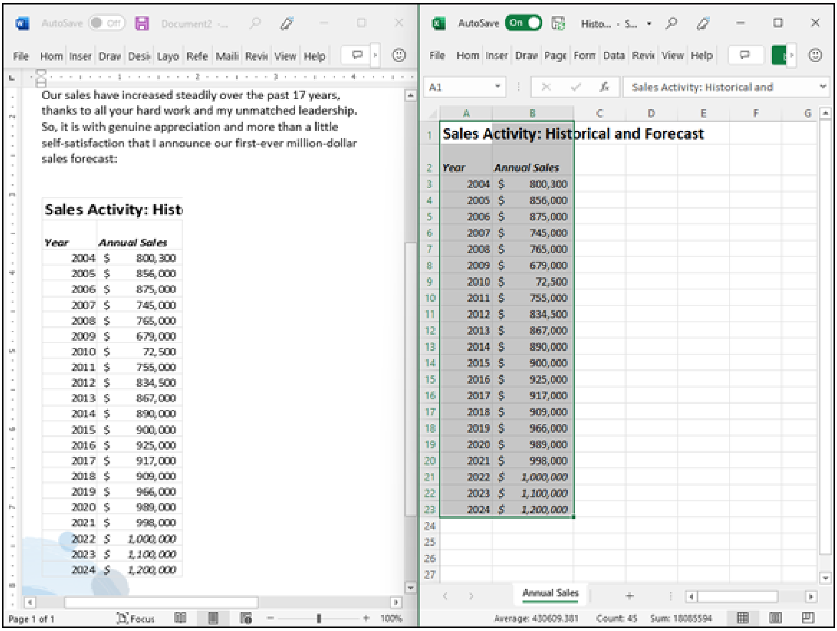
To: ALL STAFF

From: Your Peerless Leader

Our sales have increased steadily over the past 17 years, thanks to all your hard work and my unmatched leadership. So, it is with genuine appreciation and more than a little self-satisfaction that I announce our first-ever million-dollar sales forecast:

	A	B
1	**Sales Activity: Historical and Forecast**	
2	***Year***	***Annual Sales***
3	2004	$ 800,300
4	2005	$ 856,000
5	2006	$ 875,000
6	2007	$ 745,000
7	2008	$ 765,000
8	2009	$ 679,000
9	2010	$ 72,500
10	2011	$ 755,000
11	2012	$ 834,500
12	2013	$ 867,000
13	2014	$ 890,000
14	2015	$ 900,000
15	2016	$ 925,000
16	2017	$ 917,000
17	2018	$ 909,000
18	2019	$ 966,000
19	2020	$ 989,000
20	2021	$ 998,000
21	2022	$ *1,000,000*
22	2023	$ *1,100,000*
23	2024	$ *1,200,000*

FIGURE 3-4: Dragging the cell range A1:B23 from the Historical Sales worksheet to the Word memo (Sample workbook: Historical and Forecast Sales.xlsx).



Our sales have increased steadily over the past 17 years, thanks to all your hard work and my unmatched leadership. So, it is with genuine appreciation and more than a little self-satisfaction that I announce our first-ever million-dollar sales forecast:

Sales Activity: Hist

Year	Annual Sales
2004	$ 800,300
2005	$ 856,000
2006	$ 875,000
2007	$ 745,000
2008	$ 765,000
2009	$ 679,000
2010	$ 72,500
2011	$ 755,000
2012	$ 834,500
2013	$ 867,000
2014	$ 890,000
2015	$ 900,000
2016	$ 925,000
2017	$ 917,000
2018	$ 909,000
2019	$ 966,000
2020	$ 989,000
2021	$ 998,000
2022	$ *1,000,000*
2023	$ *1,100,000*
2024	$ *1,200,000*

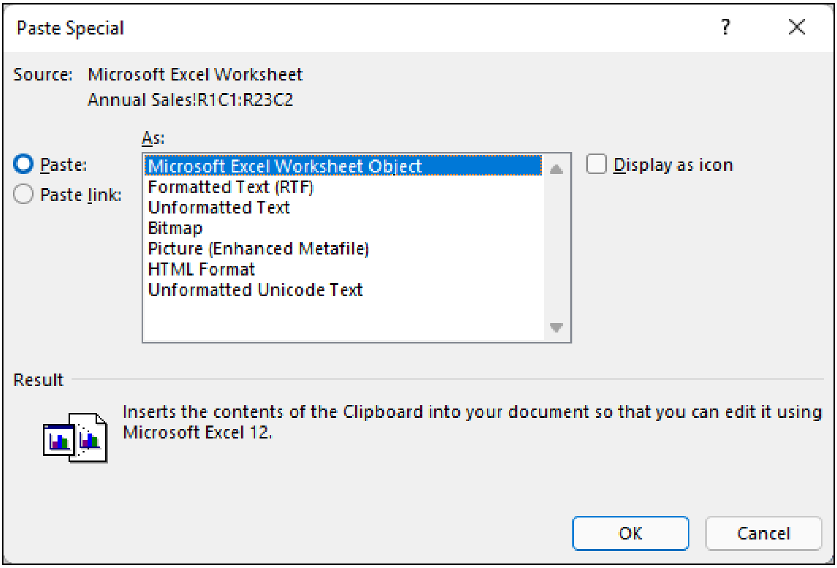
Sales Activity: Historical and Forecast

Year	Annual Sales
2004	$ 800,300
2005	$ 856,000
2006	$ 875,000
2007	$ 745,000
2008	$ 765,000
2009	$ 679,000
2010	$ 72,500
2011	$ 755,000
2012	$ 834,500
2013	$ 867,000
2014	$ 890,000
2015	$ 900,000
2016	$ 925,000
2017	$ 917,000
2018	$ 909,000
2019	$ 966,000
2020	$ 989,000
2021	$ 998,000
2022	$ *1,000,000*
2023	$ *1,100,000*
2024	$ *1,200,000*

FIGURE 3-5: Word memo after copying the worksheet data.

As I passed over the border between the Excel and Word program windows, the mouse pointer changed shape to the international “oh-no-you-don’t” symbol. When I reached the safe havens of the Word document area, however, the pointer changed again, this time to the shape of an arrowhead sticking up from a box with a plus sign. (How’s that for a description?) To indicate where in the Word document to embed the selected data, I positioned the arrowhead-sticking-up-from-a-box-with-a-plus-sign pointer at the place in the document where I wanted the Excel stuff to appear. Then I released the mouse button. Figure 3-5 shows you the embedded worksheet table that appeared after I released the mouse button.

You can also use the copy-and-paste method to embed worksheet data into a Word document. Select the cells in Excel and then copy them to the Clipboard by clicking the Home tab's Copy button (or press Ctrl +C). Then, open the Word document and position the cursor at the place where the worksheet table is to appear. In Word's Home tab, click the Paste button's drop-down arrow and then click Paste Special (or press Alt+HVS). In the Paste Special dialog box that appears, as shown in Figure 3-6, click Microsoft Excel Worksheet Object in the As list and then click OK. Word embeds the data in the body of the Word document just as though you had Ctrl+dragged the data from the Excel window over to the Word window.



Paste Special
?
Source:
As:
Microsoft Excel Worksheet Object
Formatted Text (RTF)
Unformatted Text
Bitmap
Picture (Enhanced Metafile)
HTML Format
Unformatted Unicode Text
☐ Display as icon
Result
OK
Cancel

Source: Microsoft Excel Worksheet
Annual Sales!R1C1:R23C2

● Paste: Microsoft Excel Worksheet Object
○ Paste link:

Inserts the contents of the Clipboard into your document so that you can edit it using Microsoft Excel 12.

FIGURE 3-6: With the copy-and-paste method, use the Paste Special dialog box to tell Word what type of data you're embedding.

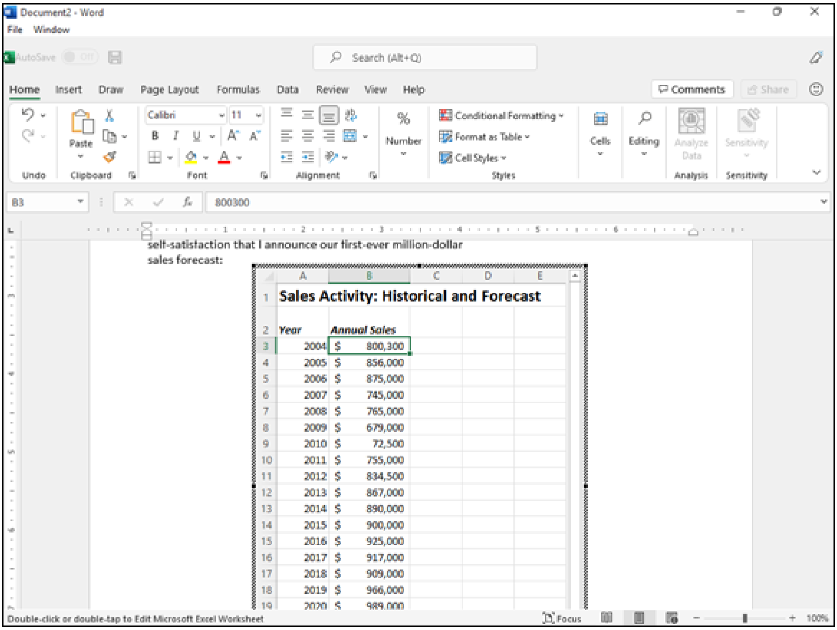
Editing embedded stuff

The great thing about embedding Excel data (as opposed to linking, which I get to in the next section) is that you can edit the data within Word itself. Figure 3-7 shows the table after I centered it and widened it (by dragging a sizing handle). Notice what happens when I double-click the embedded table (or right-click the table and then choose Worksheet Object⇒ Edit from the shortcut menu): A frame with Excel's familiar column and row headers, scroll bars, and the gridlines of Excel's worksheet area appear. Notice, too, that Word's Ribbon has been temporarily replaced by Excel's Ribbon. At this point, you can edit any of the table's contents by using the Excel commands that you already know.

The links that bind

Of course, as nice as embedding is, you will encounter occasions when linking the Excel data to the Word document is the preferred method (and, in fact, even easier to do). First, select the data in Excel. Note that you select a chart created in the worksheet by *single*-clicking it, not double-clicking it, as you would do to edit the chart in the worksheet. Then, in Excel's Home tab, click Copy to send the data to the Clipboard.

In Word, position the insertion point at the beginning of the paragraph where the data needs to be. On the Home tab, click the Paste drop-down arrow and then click Paste Special. (You can also do this by pressing Alt + HVS.) In the Paste Special dialog box that appears (see Figure 3-8) select the Paste Link option button, use the As list to select the type of data you're pasting, such as Microsoft Excel Chart Object, and then click OK. Figure 3-9 shows the Word memo after I clicked OK and pasted the Excel chart into place.


Document2 - Word
File
Window
AutoSave
Off
Search (Alt+Q)
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Help
Comments
Share
Undo
Paste
Clipboard
Calibri
11
B
I
U
Font
Alignment
Number
Conditional Formatting
Format as Table
Cell Styles
Styles
Cells
Editing
Analyze Data
Analysis
Sensitivity
Sensitivity
B3
Focus
100%

800300

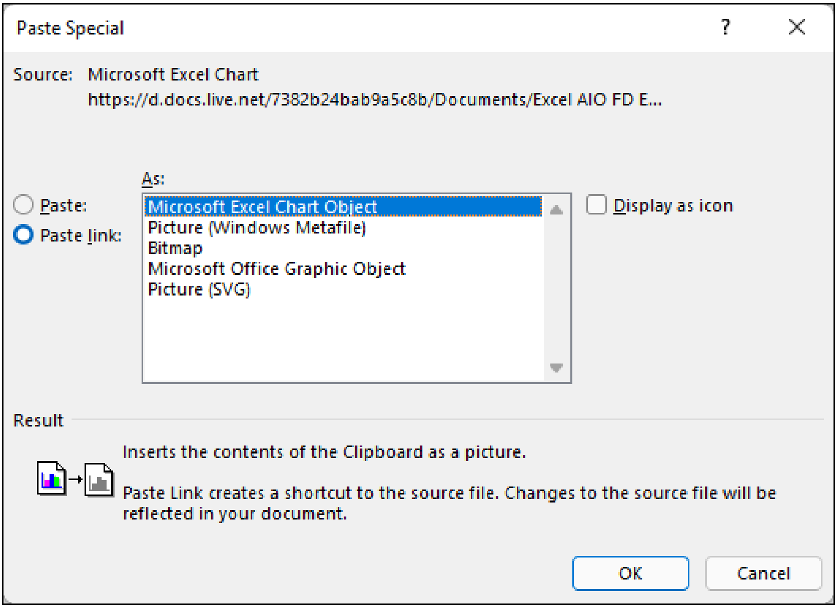
self-satisfaction that I announce our first-ever million-dollar sales forecast:

Sales Activity: Historical and Forecast

Year	Annual Sales
2004	$ 800,300
2005	$ 856,000
2006	$ 875,000
2007	$ 745,000
2008	$ 765,000
2009	$ 679,000
2010	$ 72,500
2011	$ 755,000
2012	$ 834,500
2013	$ 867,000
2014	$ 890,000
2015	$ 900,000
2016	$ 925,000
2017	$ 917,000
2018	$ 909,000
2019	$ 966,000
2020	$ 989,000

Double-click or double-tap to Edit Microsoft Excel Worksheet

FIGURE 3-7: Editing the embedded worksheet sales data from within the Word memo.



Source: Microsoft Excel Chart
https://d.docs.live.net/7382b24bab9a5c8b/Documents/Excel AIO FD E...

○ Paste:
● Paste link:

As:
- Microsoft Excel Chart Object
- Picture (Windows Metafile)
- Bitmap
- Microsoft Office Graphic Object
- Picture (SVG)

☐ Display as icon

Result

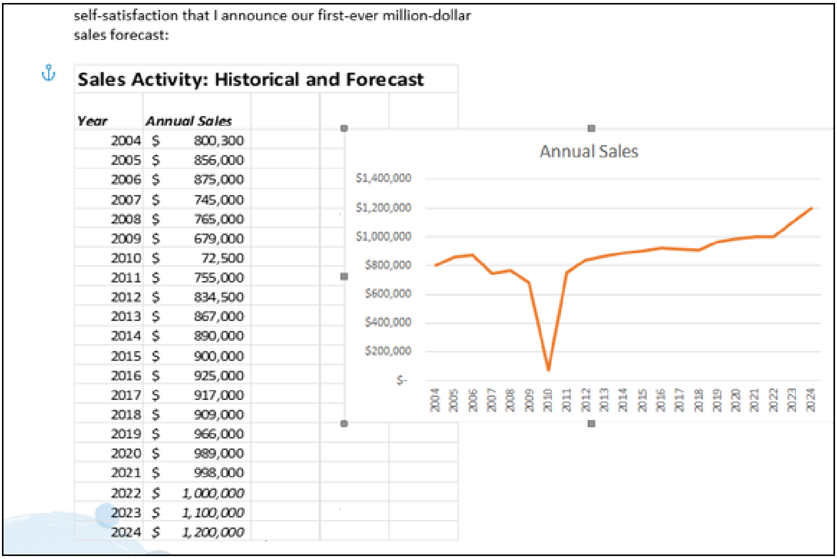
Inserts the contents of the Clipboard as a picture.

Paste Link creates a shortcut to the source file. Changes to the source file will be reflected in your document.

FIGURE 3-8: To link data, select the Paste Link option in Word's Paste Special dialog box.

Editing linked data

Editing data linked to Excel (as a chart or range) is not quite as delightful as editing embedded worksheet data. For one thing, you first have to go back to Excel and make your changes — although you can easily open Excel and its workbook just by double-clicking the linked chart. The nice thing, however, is that any changes that you make to the original data or chart are immediately reflected in the Word document the moment you open it.



self-satisfaction that I announce our first-ever million-dollar sales forecast:

Sales Activity: Historical and Forecast

Year	*Annual Sales*
2004	$ 800,300
2005	$ 856,000
2006	$ 875,000
2007	$ 745,000
2008	$ 765,000
2009	$ 679,000
2010	$ 72,500
2011	$ 755,000
2012	$ 834,500
2013	$ 867,000
2014	$ 890,000
2015	$ 900,000
2016	$ 925,000
2017	$ 917,000
2018	$ 909,000
2019	$ 966,000
2020	$ 989,000
2021	$ 998,000
2022	*$ 1,000,000*
2023	*$ 1,100,000*
2024	*$ 1,200,000*

FIGURE 3-9: A linked chart pasted into the Word memo.

Sharing data between Excel and PowerPoint

The process of embedding and linking worksheet data and charts in the slides of your Microsoft PowerPoint presentations is very similar to the techniques I outlined for Word in the last few sections. To embed a range or chart, drag the data or chart object from the Excel worksheet to the PowerPoint slide. If you prefer using the cut-and-paste method, copy the data or chart to the Clipboard (Ctrl + C), switch to PowerPoint, click the Home tab's Paste drop-down arrow, and then click Paste Special (or press Alt + HVS). In the As list, select Microsoft Excel Worksheet Object, select the Paste option button, and then click OK.

If you want to link Excel data or a chart that you pasted into a PowerPoint presentation slide to its source Excel workbook, the only thing you do differently is to click the Paste Link option button in the Paste Special dialog box.

TIP

Sometimes, after making changes to the linked data or chart in Excel, you need to manually update the link in the PowerPoint presentation slide to ensure that your presentation has the latest-and-greatest version of the Excel data. To manually update a linked table of Excel worksheet data or a linked chart, go to the slide in question, right-click the table or chart, and then choose Update Link from its shortcut menu.

Figure 3-10 illustrates how easy it is to edit an Excel chart that is embedded in a PowerPoint slide. To edit the data within PowerPoint, click the chart on the slide. The PowerPoint Ribbon then adds the Chart Design and Format contextual tabs so that you can use their command buttons to make your changes. (See Book 5, Chapter 1 to find out to create and edit Excel charts.)

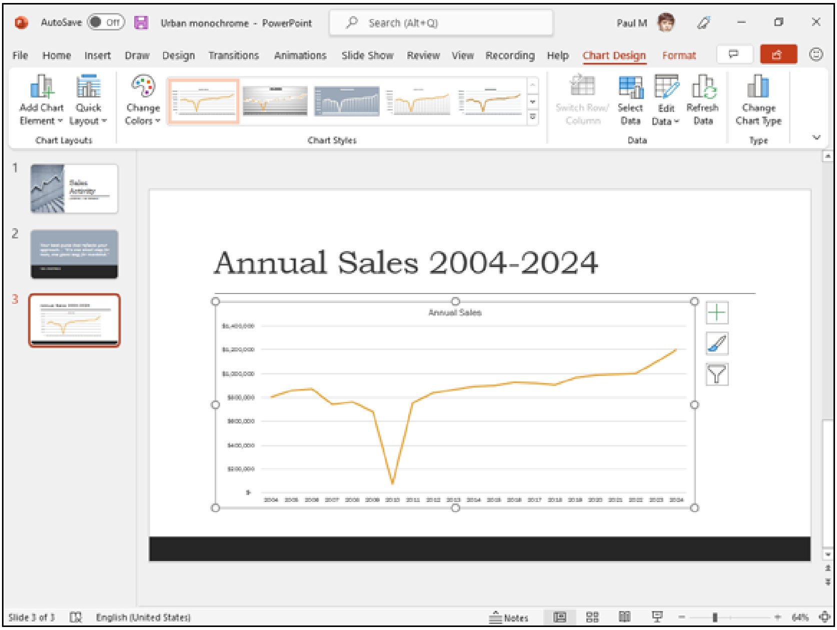

AutoSave Off
Urban monochrome - PowerPoint
Search (Alt+Q)
Paul M
File
Home
Insert
Draw
Design
Transitions
Animations
Slide Show
Review
View
Recording
Help
Chart Design
Format
Add Chart Element
Quick Layout
Change Colors
Chart Layouts
Chart Styles
Switch Row/ Column
Select Data
Edit Data
Refresh Data
Data
Change Chart Type
Type
1
2
3
Annual Sales 2004-2024
Annual Sales
$1,400,000
$1,200,000
$1,000,000
$800,000
$600,000
$400,000
$200,000
$-
2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Slide 3 of 3
English (United States)
Notes
64%

FIGURE 3-10: Editing an embedded Excel chart in a PowerPoint slide.

Making Shared Workbooks Accessible

Are your eyes, ears, or limbs not working as well as they once did? Or perhaps you've always faced challenges with your eyesight, hearing, or dexterity. Even if you don't have these types of issues, did you know that, according to the World Health Organization, 15 percent of the world's population identify as having a disability? That's an eye-popping number and it means that if you share your workbooks with other people, there's a good chance that someone (or likely several someones) will be trying to review your work with a visual, auditory, or mobility impairment. So, it's important to take a bit of extra time before clicking “Share” to make sure your workbooks are accessible to everyone who will review them. Fortunately, as the following sections show, making Excel data accessible takes a minimum of effort.

Some useful accessibility guidelines and tweaks

To get your accessibility enhancements off to a good start, you can apply these few simple dos and don'ts to your workbooks before sharing them:

- **Organize your worksheets and worksheet content in a logical order.** Screen readers go through your worksheets from left to right and they read worksheet content from left to right and from top to bottom. Make sure you organize your data so that this reading order makes sense to the reviewer.
- **Add alternative text to images.** If you use visuals — such as charts, pictures, videos, and shapes — to convey information in your worksheet, add alternative text to help reviewers who can't see the visuals. I show you how to add alternative text in the next section.
- **Don't use visuals to convey important text.** You can use visuals such as shapes and SmartArt graphics to convey text, but you run the risk of having some reviewers unable to see the visual and, hence, the text. Move the text out of the visual and into the worksheet where everyone can access it. If you really want to keep the visual, either repeat the text in the worksheet or add alternative text to the visual.
- **Don't use red text for negative numbers.** The color-blind or visually impaired may not be able to see the red, so always denote a negative number using either a minus sign (-) or parentheses.
- **Don't use a worksheet background color or image that make the text hard to read.** Always strive for a decent amount of contrast between the text color and the background color. The easiest way to achieve this is to use the default white background and apply the Automatic option (black) for text color.
- **Give your worksheet tabs descriptive names.** Screen readers say the name of the active worksheet, so you're doing visually

impaired reviewers a big favor by making your sheet names descriptive enough to accurately summarize the sheet content.

- **Delete blank worksheets.** To make it easier to navigate your workbook, remove any blank worksheets.
- **Make your tables accessible.** An accessible table is one that's easy for a screen reader to parse. That means having descriptive column headings (and descriptive row headings if you use them); no blank cells; no merged or split cells; and no nested tables.

Adding alternative text to graphics

Adding visuals such as charts, pictures, videos, shapes, and SmartArt is great for both sprucing up an otherwise drab worksheet and for conveying information in an interesting way. Unfortunately, some of the people reviewing your Excel data won't be able to see those visuals, so the bits of information the visuals are meant to convey are lost.

You can go a long way to solving this problem by adding *alternative text*, or *alt text*. Alt text is a short description of the visual. A screen reader that comes upon a visual element that includes alt text reads that text aloud. So even though the reviewer may not be able to see the visual, your alt text lets that person know what the visual is all about.

Before I show you how to add alt text to Excel's visual elements, here are a few points to bear in mind when writing alt text:

- The purpose of alt text is to tell the reviewer the purpose and content of the visual.
- Keep alt text relatively short: one or two sentences is usually more than enough.
- You can keep things concise and pithy by remembering that you don't need to describe everything visible in the image. Instead, just state what the visual is meant to convey and describe the key elements of the visual.
- Be as precise and as unambiguous as you can.
- Don't include in your alt text any text that's already on the worksheet.
- Don't start the alt text with phrases such as “A visual of…” or “A picture that shows…”.

Here are the steps to follow to add alt text to a picture, shape, icon, SmartArt graphic, or chart:

1. **Select the visual.**

   If the visual contains editable text (or editable elements, such as a chart or SmartArt graphic), selecting the visual usually means clicking one of its borders. You’re really trying here to make sure you're not opening the visual for editing.

   Excel displays the Format contextual tab which, depending on the type of visual, could be named Format, Graphics Format, or Picture Format.

2. **In the Format contextual tab's Accessibility group, click Alt Text.**

   Alternatively, right-click the visual and then click Edit Alt Text, or in the Review tab, choose Check Accessibility⇒ Alt Text.

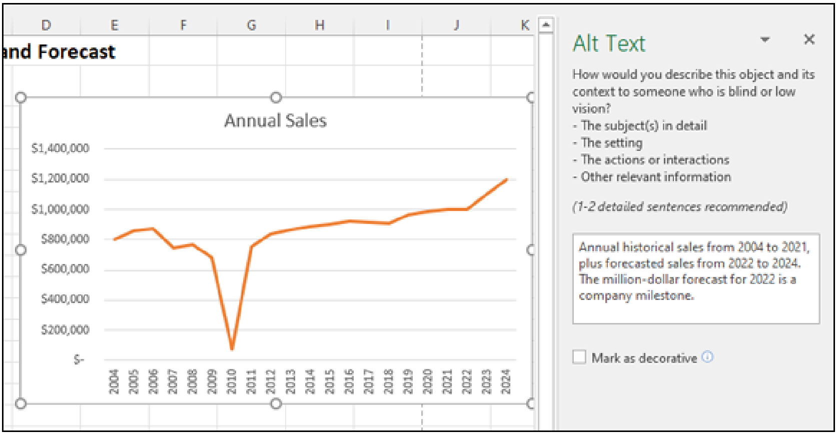
   Excel displays the Alt Text pane.

3. **(Optional) If the visual is for decoration purposes only, select the Mark as Decorative check box and don't bother writing any alt text.**

   If a visual isn't meant to convey any information relevant to your worksheet, do your screen-reader-using reviewers a favor by marking the visual as decorative. The screen reader tells the reviewer that the visual is decorative and contains no important information.

4. **Write your alt text in the large text box, as shown in Figure 3-11 (sample workbook: Historical and Forecast Sales.xlsx).**

5. **Click Close (X) to hide the Alt Text pane.**


D
E
F
G
H
I
J
K
nd Forecast
Annual Sales
$1,400,000
$1,200,000
$1,000,000
$800,000
$600,000
$400,000
$200,000
$-
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
Alt Text

How would you describe this object and its context to someone who is blind or low vision?

- The subject(s) in detail
- The setting
- The actions or interactions
- Other relevant information

(1-2 detailed sentences recommended)

Annual historical sales from 2004 to 2021, plus forecasted sales from 2022 to 2024. The million-dollar forecast for 2022 is a company milestone.

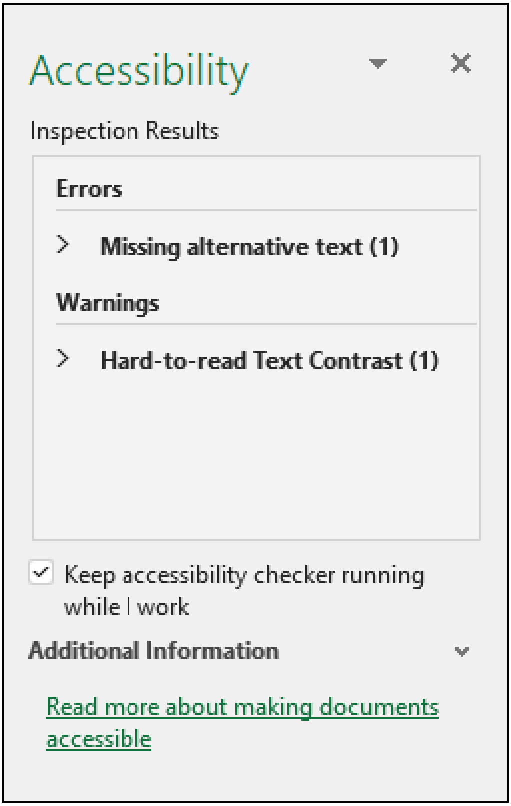
☐ Mark as decorative

FIGURE 3-11: Use the Alt Text pane to compose your alternative text for a visual element, such as a chart. (Sample workbook: Historical and Forecast Sales.xlsx)

Running the Accessibility Checker

The accessibility enhancements I listed earlier in the “Some useful accessibility guidelines and tweaks” aren't hard to implement, but they can be hard to remember. Fortunately, you can get Excel to do the hard work for you by remembering just one thing: to run the Accessibility Checker, which is a tool that scours a workbook for accessibility issues such as missing alt text, missing column and/or row headings in a table, poor text color contrast, and much more.

To run the Accessibility Checker, display the Review tab and click the top half of the Check Accessibility button. Excel opens the Accessibility pane, which includes an Inspection Results section that lists any accessibility issues that need fixing (see Figure 3-12).



Accessibility

Inspection Results

Errors

Missing alternative text (1)

Warnings

Hard-to-read Text Contrast (1)

☑ Keep accessibility checker running while I work

Additional Information

Read more about making documents accessible

FIGURE 3-12: If the Accessibility Checker discovers one or more ways you can make your worksheet more inclusive, it lists them in the Accessibility pane.

TIP

Rather than running the Accessibility Checker manually, you can have it running full-time in the background. That way, Excel alerts you immediately if an edit or a format change runs afoul of the Accessibility Checker. In the Accessibility pane, select the Keep Accessibility Checker Running While I Work check box. Alternatively, choose File⇒ Options to open the Excel Options dialog box, display the Ease of Access tab, select the Keep Accessibility Checker Running While I Work check box, and then click OK. If Excel finds any accessibility issues, you see the text Accessibility: Investigate on the Status bar. Click that text to open the Accessibility pane and see the problem.

Exporting Workbooks to Other Usable File Formats

Sometimes you may need to share Excel data with coworkers and clients who don't have Excel installed on their computers. It's hard to imagine a coworker or client getting by without Excel, but it does happen. For those rare occasions, you can export your Excel workbook to one of four usable file formats for opening and printing with readily available software programs that support them:

- **PDF files** for opening with Adobe Reader or Adobe Acrobat
- **XPS files** for opening with the XML Paper Specification Viewer or a newer web browser
- **ODS files** for opening with open-source spreadsheet program LibreOffice Calc
- **HTML files** for opening with all types and versions of web browsers

When converting an Excel workbook to one of these other file formats, you can either change the file type in the Save As dialog box, or you can export them from the Export screen in the Backstage view.

Saving and exporting worksheets as PDF files

The PDF (Portable Document File) file format, developed by Adobe Systems Incorporated, enables people to open and print documents without any access to the original programs with which the documents were created. All they then need installed to be able to open and print the worksheet-as-PDF file is a copy of Adobe Reader (a free download from `www.adobe.com`), a copy of Adobe's Acrobat software, or a third-party app that can open PDF files.

Excel enables you to save your workbook files directly in this special PDF file format. To save a workbook as a PDF file, choose File⇒ Save As or File⇒ Save a Copy (Alt+FA), select the place where you want to save the new PDF file in the Save As screen, and then select PDF (*.pdf) from the Save as Type drop-down list.

You can modify the filename and the drive and folder in which the new PDF file is saved and click More Options to change any of the following options added to the bottom of the Save As dialog box:

- **Optimize For:** Select the Standard (Publishing Online and Printing) option for the highest fidelity; select the Minimum Size (Publishing Online) option to compress the resulting PDF document for use on the web.
- **Open File after Publishing:** Select this check box to have Excel automatically open the new PDF file in your copy of Adobe Reader or Acrobat.
- **Options:** Click this button to open the Options dialog box where you can select the part of the workbook or worksheet to publish and choose to not have the document properties and accessibility tags included in the resulting PDF file.

After you designate the filename and file location and select your PDF file options, click the Save button to have Excel save the workbook (or some part of it) in a new PDF file.

Besides saving your workbook file in the PDF file format using the Save As dialog box, you can also accomplish the same thing from the Export screen. Choose File⇒ Export, click Create PDF/XPS, and then click the Create PDF/XPS button to open the Publish as PDF or XPS dialog box. In the Publish as PDF or XPS (which pretty much looks and acts like the Save As dialog box when PDF is selected as the file type), PDF is automatically selected as the file format type, and you can then use the Folder list box, File Name text box, and PDF options (in a slightly different order) as needed before clicking the Publish button to save the PDF file version of your Excel workbook.

TIP

If you create an Excel workbook that incorporates new features not supported in earlier versions of Excel, instead of saving the workbook as an `.xls` file, thereby losing all its up-to-date enhancements, consider saving it as a PDF file so that coworkers still using pre-2007 Excel versions can still have access to the data in all its glory via the Adobe Reader.

Saving worksheets as XPS files

The XPS (XML Paper Specification) file format also enables people to open and print Excel worksheets without access to the Excel program. As with the PDF format, you can convert a workbook to an XPS file either in the Save As dialog box opened from the Save As screen (Alt +FA) or in the Publish as PDF or XPS dialog box opened from the

Export screen by clicking the Create PDF/XPS button (Alt+FEPA).

From either dialog box, you need to choose XPS Document as the file format from the Save as Type drop-down menu. And in either dialog box, you have access (in a slightly different order) to Optimize For option buttons, Open File After Publishing check box, and the Options command button for controlling the file size and what to do after it's created.

After choosing XPS Document as the file type, if you don't need to edit the filename (Excel automatically appends `.xps` to the current filename) or the folder location, click the Save button (in the Save As dialog box) or Publish button (in the Publish as PDF or XPS dialog box), and Excel saves the workbook in an XPS file.

If you want Excel to automatically open the new XPS file for your inspection in Microsoft Edge or the XPS Viewer, make sure that the Open File after Publishing check box is selected before you click the Publish button.

TIP By default, the Standard (Publishing Online and Printing) option button is selected in the Optimize For section at the bottom of the Publish as PDF or XPS dialog box. If you want to make your XPS file version of the worksheet smaller for viewing online, click the Minimum Size (Publishing Online) option button before you click the Publish button. Also, if you need to restrict which parts of the current workbook are included in the new XPS file or don’t want nonprinting information included in the resulting file, open the Options dialog box by clicking the Options button and select the part of the workbook or worksheet to publish and choose which nonprinting information to omit from the resulting XPS file.

Saving worksheets as ODS files

ODS (OpenDocument Spreadsheet) is the default spreadsheet file format that LibreOffice Calc, the spreadsheet program that comes with the open source and completely free LibreOffice suite, uses. To save your Excel workbook in this file format, choose the OpenDocument Spreadsheet (*.ods) option at the very bottom of the Save as Type drop-down list in the Excel Save As dialog box.

REMEMBER LibreOffice Calc can open native Excel workbook files (either `.xls` or `.xlsx`) just as Excel can open `.ods` files without any prior conversion.

Saving worksheets as HTML files

If converting your worksheets to PDF or XPS files is way too complex for your needs, you can save your worksheets as good old HTML files for viewing and printing in anybody's web browser (as well as for publishing to your website). To save

1. **Choose File⇒ Save As (or File⇒ Save a Copy) or press Alt+FA to open the Save As screen in the Backstage view.**

   Here you select the place into which to save the HTML file.

2. **Select the drive and folder where you want the web version of the workbook saved.**

   Excel opens the Save As dialog box with the drive and folder you just designated open and selected.

3. **Choose Single File Web Page or Web Page from the Save as Type drop-down menu.**

   The Single File Web Page file format creates a web page archive file (using the `.mht` file extension) that contains all the data needed for the workbook. The Web Page file format creates an HTML file containing whichever worksheets you choose to include.

   When you select either web page option, Excel expands the Save As dialog box to include the Entire Workbook (selected by default) and Selection: Sheet option buttons along with the Page Title text box and Change Title command button.

   Next, you need to give a new filename to your web page in the File Name text box. Note that Excel automatically appends the filename extension `.htm` (for Hypertext Markup page) to whatever filename you enter here. When selecting a filename, keep in mind that some file servers (especially those running some flavor of UNIX) are sensitive to upper- and lowercase letters in the name.

4. **Enter the filename for the new HTML file in the File Name text box.**

   By default, Excel selects the Entire Workbook option button, meaning that all the worksheets in the workbook that contain data will be included in the new HTML file. To save only the data on the current worksheet in the HTML file, you need to take Step 5.

5. **(Optional) If you want only the current worksheet saved in the new HTML file, select the Selection: Sheet option button.**

   If you want, you can have Excel add a Page title to your new HTML file by taking Step 6. The page appears centered at the top of the page right above your worksheet data. Don't confuse the page title with the web page header that appears on the web browser's title bar — the only way to set the web page header is to edit this HTML tag after the HTML file is created.

6. **(Optional) If you want to add a page title to your HTML file, click the Change Title button and then type the text in the Page Title text box in the Set Page Title dialog box before you click OK.**

   You’re now ready to save your workbook as an HTML file by clicking the Save button. If you want to see how this file looks in your web browser immediately upon saving it, click the Publish button to open the Publish as Web Page dialog box and save the file from there after selecting the Open Published Web Page in Browser check box. And if you want Excel to automatically save an HTML version of the worksheet each time you save the workbook, you select the AutoRepublish Every Time This Workbook Is Saved check box as well.

7. **Click the Save button to save the file without opening it in your web browser. Otherwise, click the Publish button so that you can see the web page in your browser right after saving it.**

   If you click the Save button, Excel closes the Save As dialog box, saves the file to disk, and returns to the Excel window (that now contains the HTML version of your workbook or worksheet in place of the original `.xls` file).

   If you click the Publish button to view the new HTML file in your browser, Excel opens the Publish as Web Page dialog box, where you select the Open Published Web Page in Browser check box before clicking the Publish button.

8. **Click the Open Published Web Page in Browser check box and then click the Publish button.**

   When you click the Publish button, Excel closes the Publish As Web Page dialog box, saves the worksheet as an HTML file, and then immediately launches your default web browsing program while at the same time opening the new HTML file in the browser. After you finish looking over the new HTML file in your web browser, click its program window's Close button to close the browser and HTML file and to return to Excel and the original worksheet.

TIP

If you add the Web Page Preview and Web Options commands as custom buttons to the Quick Access toolbar, you can use them to preview how a worksheet will appear as a web page locally in your web browser as well as control a whole variety of web page save options. To add these buttons, open the Customize the Quick Access Toolbar tab of the Excel Options dialog box (Alt+FTQ) and then add the Web Page Preview and Web Options from Commands Not in the Ribbon section. (See Book 1, Chapter 2 for details.)

Collaborating Conversationally with Comments

Adding a note to a cell (see Book 4, Chapter 2) is a useful way to both annotate a workbook for your own purposes and to supply information to other people with whom you share the workbook. Similarly, workbook reviewers can use cell notes to provide feedback, make suggested corrections, and so on.

In a sharing context, the problem with notes is that they only go one way: You can offer information to your reviewers, and they can offer you feedback, but there's no real give-and-take here. One solution would be to have each reviewer record their feedback in an email, which enables you to respond to that feedback, the reviewer then responds back, and so on.

That's fine, but feedback is most useful when it appears in the proper context. That is, if someone has a question, suggestion, or correction related to a workbook's cell value, you'll understand that feedback more readily not only if it appears within that workbook but if it's attached to the cell in question.

To create a feedback conversation linked to a specific cell, you insert a *comment*, which is a separate section of text that's associated with a particular cell. That sounds just like a note, I know, but the key difference is that you can reply to a comment, the reviewer can reply to your reply, and so on, and the entire conversation is linked to the original cell.

Inserting a comment

To insert a comment, follow these steps:

1. **Select the cell you want to comment on.**
2. **Choose Review⇒ New Comment.**

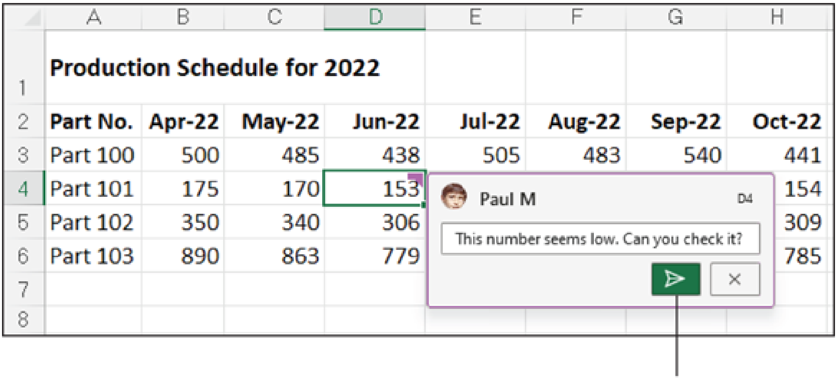
   Excel displays a purple comment indicator in the upper-right corner of the cell and displays a text box for entering a comment.

3. **Use the Start a Conversation text box to type the comment, as shown in Figure 3-13.**

   TIP You can supply multiline feedback by pressing Enter at the end of a line.

4. **Click Post Comment or press Ctrl+Enter.**

   Excel posts the comment to the cell.



	A	B	C	D	E	F	G	H
1	**Production Schedule for 2022**							
2	**Part No.**	**Apr-22**	**May-22**	**Jun-22**	**Jul-22**	**Aug-22**	**Sep-22**	**Oct-22**
3	Part 100	500	485	438	505	483	540	441
4	Part 101	175	170	153				154
5	Part 102	350	340	306				309
6	Part 103	890	863	779				785
7								
8								

This number seems low. Can you check it?

Post Comment

FIGURE 3-13: Use this dialog box to type and post your comment.

Displaying and hiding comments

Excel indicates that you've attached a comment to a worksheet cell by adding a purple flag to the cell's upper-right corner. To display the

Note box with its text, you position the thick, white-cross mouse pointer within the cell, or you can click the Review tab’s Show Comments command (Alt+RH1) to open the Comments pane, which displays all the comments.

When you display a comment by positioning the mouse pointer over the cell, the comment disappears as soon as you move the pointer outside the cell. When you display all the comments on the worksheet by clicking the Review tab’s Show Comments command, you must click the Show Comments button a second time, or click the Comment's pane's Close button (X).

Editing a comment

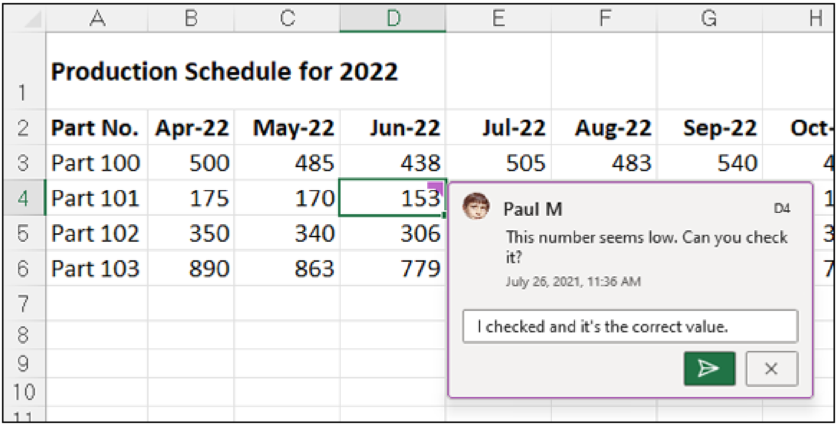
To edit your comment text, first either hover the mouse pointer over the cell to display the Comment box or choose Review⇒ Show Comments to open the Comments pane. Click the comment's More Thread Actions icon (the three dots in the upper-right corner of the Comment box), and then click Edit Comment. Edit your comment text and then click Save (the check mark button).

Replying to a comment

The whole point of Excel's Comments feature is to create a conversation between yourself and one or more workbook reviewers. If you've been tasked to review a workbook, or if your reviewers have supplied some comment feedback, then it's your turn to respond. Excel gives you two ways to reply to a comment in a particular cell:

- Hover the mouse pointer over the cell to display the Comment box or choose Review⇒ Show Comments to open the Comments pane.
- Right-click the cell that contains the comment and then click Reply to Comment.

Type your response in the Reply text box (see Figure 3-14), and then click Post Reply (or press Ctrl+Enter).



	A	B	C	D	E	F	G	H
1	**Production Schedule for 2022**							
2	**Part No.**	**Apr-22**	**May-22**	**Jun-22**	**Jul-22**	**Aug-22**	**Sep-22**	**Oct-**
3	Part 100	500	485	438	505	483	540	4
4	Part 101	175	170	153				1
5	Part 102	350	340	306				3
6	Part 103	890	863	779				7
7								
8								
9								
10								

Paul M D4

This number seems low. Can you check it?

July 26, 2021, 11:36 AM

I checked and it's the correct value.

FIGURE 3-14: Use this dialog box to type and post a comment reply.

Deleting a comment

When you no longer need a comment, you can delete it by selecting its cell before you do any of the following:

- Either hover the mouse pointer over the cell to display the Comment box or choose Review⇒ Show Comments to open the Comments pane. Click the comment's More Thread Actions icon (the three dots in the upper-right corner of the Comment box), and then click Delete Comment.
- In the Home tab's Editing group, choose Clear⇒ Clear Comments and Notes (or press Alt+HEM).
- Right-click the cell and then click Delete Comment from its shortcut menu.

Book 5

Charts and Graphics

Contents at a Glance

Chapter 1: Charting Worksheet Data

- Worksheet Charting 101
- Adding Sparkline Graphics to a Worksheet
- Adding Infographics to a Worksheet
- Printing Charts

Chapter 2: Adding Graphic Objects

- Going Graphical: The Basics of Working with Graphic Objects
- Inserting Different Types of Graphics
- Making Changes to Graphics
- Drawing Graphics
- Adding Screenshots of the Windows Desktop
- Using Themes

Chapter 1

Charting Worksheet Data

IN THIS CHAPTER

- **Understanding how to chart worksheet data**
- **Creating an embedded chart or one on its own chart sheet**
- **Editing an existing chart**
- **Formatting the elements in a chart**
- **Saving customized charts as templates and using these templates to create new charts**
- **Adding sparklines to worksheet data**
- **Printing a chart alone or with its supporting data**

Charts present the data from your worksheet visually by representing the data in rows and columns as bars on a chart, for example, or as pieces of a pie in a pie chart. For a long time, charts and graphs have gone hand-in-hand with spreadsheets because they enable you to see trends and patterns that you often can't glean from the numbers alone. Which has more consistent sales, the Southeast region or the Northwest region? Monthly sales reports may contain the answer, but a bar chart based on the data shows it more clearly.

In this chapter, you first become familiar with the terminology that Excel uses as it refers to the parts of a chart — terms that may be new, such as *data marker* and *chart data series,* as well as terms that are probably familiar already, such as *axis.* After you get acquainted with the terms, you begin to put them to use going through the steps required to create the kind of chart that you want, either as part of the worksheet or as a separate chart sheet.

The art of preparing a chart (and much of the fun) is matching a chart type to your purposes. To help you with this, I guide you through a tour of all the chart types available in Excel, from old standbys, such as bar and column charts, to more modern chart types with which you may be less familiar, such as Treemap, Funnel, Waterfall, and Box and Whisker charts. Finally, you discover how to print charts, either alone or as part of the worksheet.

Worksheet Charting 101

The typical Excel chart is comprised of several distinct parts. Figure 1-1 (sample workbook: CG Music with Chart Sheet.xlsx) shows an Excel clustered column chart added to a worksheet with labels identifying the parts of this chart. Table 1-1 summarizes the parts of the typical chart.

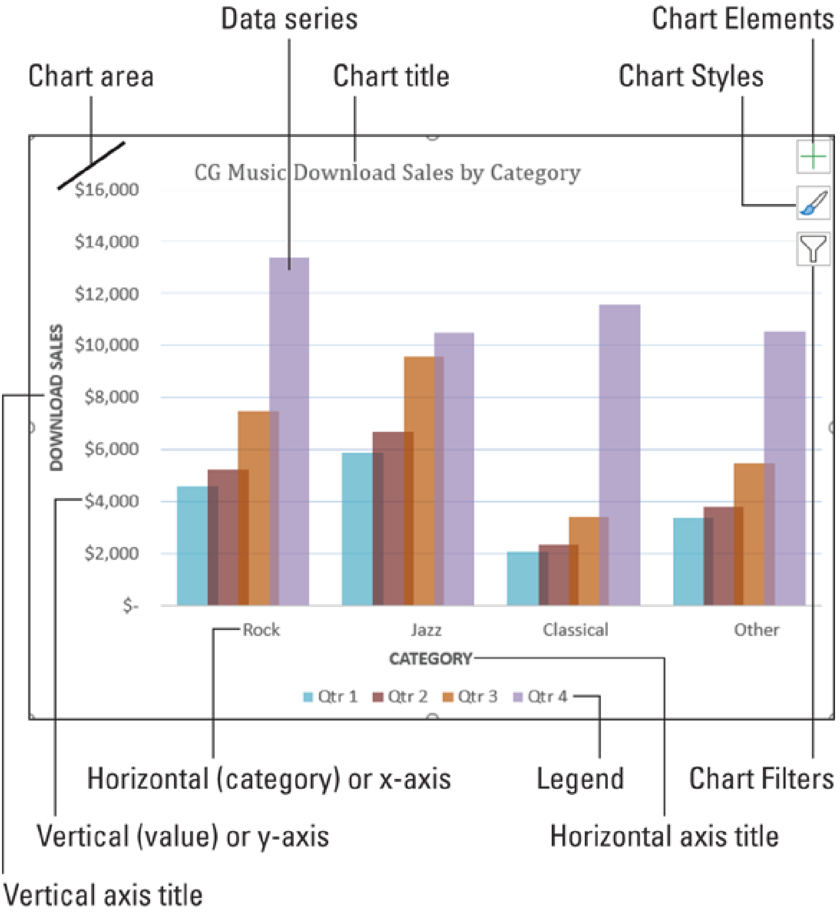


FIGURE 1-1: A typical clustered column chart containing a variety of standard chart elements. (Sample workbook: CG Music with Chart Sheet.xlsx)

TABLE 1-1 Parts of a Typical Chart

Part	Description
Chart area	Everything inside the chart window, including all parts of the chart (labels, axes, data markers, tick marks, and other elements in this table).
Data marker	A symbol on the chart that represents a single value in the worksheet. A symbol may be a column in a column chart, a slice in a pie chart, or a line on a line chart. Data markers with the same shape or pattern represent a single data series in the chart.
Chart data series	A group of related values, such as all the values in a single row in the chart — all the quarterly sales for Rock CDs in the sample chart, for example. A chart can have just one data series (shown in a single bar or line), but it usually has several.
Series formula	A formula describing a given data series. The formula includes a reference to the cell that contains the data series name, references to worksheet cells containing the categories and values plotted in the chart, and the plot order of the series. The series formula can also have the actual data used to plot the chart. You can edit a series formula and control the plot order.
Axis	A line that serves as a major reference for plotting data in a chart. In two-dimensional charts, there are two axes: the *x* (horizontal/category) axis and the *y* (vertical/value) axis. In most two-dimensional charts (except, notably, bar charts), Excel plots categories (labels) along the *x*-axis and values (numbers) along the *y*-axis. Bar charts reverse the scheme, plotting values along the *y*-axis. Pie charts have no axes. Three-dimensional charts have an *x*-axis, a *y*-axis, and a *z*-axis. The *x*- and *y*-axes delineate the horizontal surface of the chart. The *z*-axis is the vertical axis, showing the depth of the third dimension in the chart.
Tick mark	A small line intersecting an axis. A tick mark indicates a category, scale, or chart data series. A tick mark can have a label attached.
Plot area	The area where Excel plots your data, including the axes and all markers that represent data points.
Gridlines	Optional lines extending from the tick marks across the plot area, thus making it easier to view the data values represented by the tick marks.
Chart text	A label or title that you add to the chart. *Attached text* is a title or label linked to an axis such as the Chart Title, Vertical Axis Title, and Horizontal Axis Title that you can't move independently of the chart. *Unattached text* is text that you add such as a text box with the Text Box command button on the Insert tab of the Ribbon.
Legend	A key that identifies patterns, colors, or symbols associated with the markers of a chart data series. The legend shows the data series name corresponding to each data marker (such as the name of the red columns in a column chart).

Embedded charts versus separate chart sheets

An *embedded chart* appears in a worksheet, which is almost always the same worksheet that contains the chart data. Embedding a chart next to its data enables you to compare the raw data with its visualization in the chart.

MOVING AN EMBEDDED CHART ONTO ITS OWN CHART SHEET

If it’s important that the chart remain a separate element in the workbook, you can move the embedded chart onto its own chart sheet. Click the embedded chart if it’s not already selected in the worksheet and then click the Chart Design tab's Move Chart command. Excel then opens the Move dialog box, where you then click the New Sheet option button and click OK to move the embedded chart to a new chart sheet.

Note that your charts don’t have to be embedded. You can also choose to create a chart in a separate sheet called (no surprises here) a *chart sheet*. Embed a chart on the worksheet when you want to be able to view or share the chart along with its supporting worksheet data. Place a chart on its own sheet when you prefer to share the chart separately from its worksheet data (because, for example, the raw data isn't relevant or the worksheet contains data you don't want others to see).

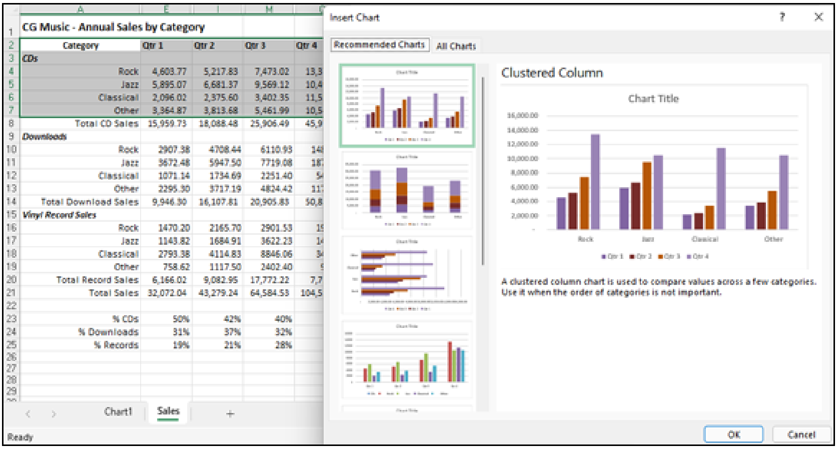
REMEMBER All charts (embedded or on their own sheets) are dynamically linked to the worksheet that they represent. This means that if you modify any of the values that are plotted in the chart, Excel immediately redraws the chart to reflect the change, assuming that the worksheet still uses automatic recalculation. When Manual recalculation is turned on, you must press F9 or click the Formulas tab's Calculate Now button (or press Alt+MB) to get Excel to redraw the chart to reflect any changes to the chart's underlying worksheet values.

TIP You can print any chart that you’ve embedded in a worksheet by itself without any worksheet data (as though it were created on its own chart sheet) by selecting it before you open the Print dialog box.

Inserting recommended charts

My personal favorite way to create a new embedded chart from selected data in a worksheet in Excel is with the Insert tab's Recommended Charts command (or press Alt+NR).

Excel opens the Insert Chart dialog box with the Recommended Charts tab selected similar to the one shown in Figure 1-2 (sample workbook: CG Music with Chart Sheet.xlsx). Here, you can preview how the selected worksheet data will appear in different types of charts by clicking a thumbnail in the list box on the left. When you find the type of chart you want to create, click OK to embed the chart in the current worksheet.



CG Music - Annual Sales by Category

Category	Qtr 1	Qtr 2	Qtr 3	Qtr 4
CDs				
Rock	4,603.77	5,217.83	7,473.02	13,3
Jazz	5,895.07	6,681.37	9,569.12	10,4
Classical	2,096.02	2,375.60	3,402.35	11,5
Other	3,364.87	3,813.68	5,461.99	10,5
Total CD Sales	15,959.73	18,088.48	25,906.49	45,9
Downloads				
Rock	2907.38	4708.44	6110.93	14
Jazz	3672.48	5947.50	7719.08	18
Classical	1071.14	1734.69	2251.40	5
Other	2295.30	3717.19	4824.42	11
Total Download Sales	9,946.30	16,107.81	20,905.83	50,8
Vinyl Record Sales				
Rock	1470.20	2165.70	2901.53	1
Jazz	1143.82	1684.91	3622.23	1
Classical	2793.38	4114.83	8846.06	3
Other	758.62	1117.50	2402.40	
Total Record Sales	6,166.02	9,082.95	17,772.22	7,7
Total Sales	32,072.04	43,279.24	64,584.53	104,5
% CDs	50%	42%	40%	
% Downloads	31%	37%	32%	
% Records	19%	21%	28%	

Clustered Column

A clustered column chart is used to compare values across a few categories. Use it when the order of categories is not important.

FIGURE 1-2: Insert Chart dialog box with the Recommended Charts tab selected. (Sample workbook: CG Music with Chart Sheet.xlsx)

Inserting specific chart types from the Ribbon

In the Insert tab's Charts group, to the right of the Recommended Charts button, Excel displays drop-down buttons with galleries for creating the following types and styles of charts:

- **Insert Column or Bar Chart:** Graphs your data as a 2-D or 3-D vertical column or horizontal bar chart.
- **Insert Hierarchy Chart:** Graphs your data in a Treemap or Sunburst hierarchy chart.
- **Insert Waterfall, Funnel, Stock, Surface, or Radar Chart:** Graphs your data as a 2-D waterfall, funnel, or stock chart (using typical stock symbols), 2-D or 3-D surface chart, or 3-D radar chart.
- **Insert Line or Area Chart:** Graphs your data as a 2-D or 3-D line or area chart.

- **Insert Statistic Chart:** Graphs your data as a 2-D histogram or box and whisker chart.
- **Insert Combo Chart:** Graphs your data as a 2-D combo clustered column and line chart or clustered column and stacked area chart.
- **Insert Pie or Doughnut Chart:** Graphs your data as a 2-D or 3-D pie chart or 2-D doughnut chart.
- **Insert Scatter (X, Y) or Bubble Chart:** Graphs your data as a 2-D scatter (X, Y) or bubble chart.
- **Maps:** Graphs your data as a 2-D filled map chart.
- **PivotChart:** Graphs your data as a PivotChart. (See Book 7, Chapter 2 for more on creating this special type of interactive summary chart.)

When a gallery attached to any of these chart buttons is displayed, hover the mouse pointer over a chart type to preview your data as that style of chart. When you find a chart type that strikes your fancy, click the chart type icon to embed the chart in your worksheet.

If you're not sure what type of chart best represents your data, rather than go through the different chart type buttons, you can use the All Charts tab of the Insert Chart dialog box shown in Figure 1-3 to "try out" your data in different chart types and styles. You can open the Insert Chart dialog box either by clicking Recommended Charts or by clicking the dialog box launcher in the lower-right corner of the Charts group, and then display the complete list of chart types by clicking the All Charts tab.

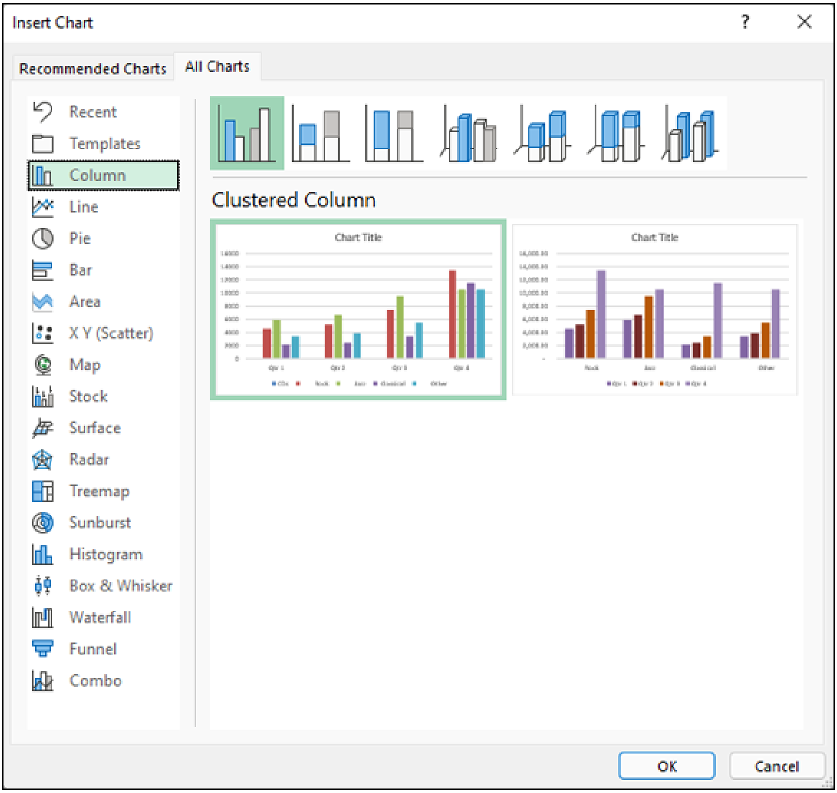

Insert Chart
?
Recommended Charts
All Charts
Recent
Templates
Column
Line
Pie
Bar
Area
X Y (Scatter)
Map
Stock
Surface
Radar
Treemap
Sunburst
Histogram
Box & Whisker
Waterfall
Funnel
Combo
Clustered Column
Chart Title
Chart Title
OK
Cancel

FIGURE 1-3: Open the Insert Chart dialog box and then use the All Charts tab to see Excel's complete lineup of chart types.

Excel includes some unusual chart types that you can preview and select from the All Charts tab in the Insert Chart dialog box. These chart types include:

- **Treemap:** Shows hierarchical data in a tree-like structure using nested rectangles of different colors representing the branches and sub-branches within related data. Treemap charts provide a great way to represent very large amounts of hierarchical data in a very compact space.
- **Box & Whisker:** Shows the spread and skew within an ordered data set or within two sets of data compared to one another. The Box and Whisker chart depicts five variables within the groups of data: maximum, upper quartile, median, lower quartile, and minimum. The maximum and minimum values are represented as thin vertical and horizontal lines (the whiskers) above and below a rectangle (the box) depicting the upper and lower quartiles with a

horizontal dividing line that represents the median.

- **Waterfall:** Shows the effect of sequential intermediate values that increase or decrease on initial values in the data set. The intermediate values showing the increase or decrease can either be based on time or on different categories. Values in the data are represented by floating columns of various sizes and colors.
- **Funnel:** Shows the progressive reduction within an ordered data set as a percentage of the whole represented as different colored slices within an inverted triangle (creating a funnel shape). Funnel charts, like pie charts, do not have an X- and Y-axis.

Inserting charts with the Quick Analysis tool

For those times when you need to select a subset of a range as the data to be charted (as opposed to selecting a single cell within a data), you can use the Quick Analysis tool to create your chart. Just follow these steps:

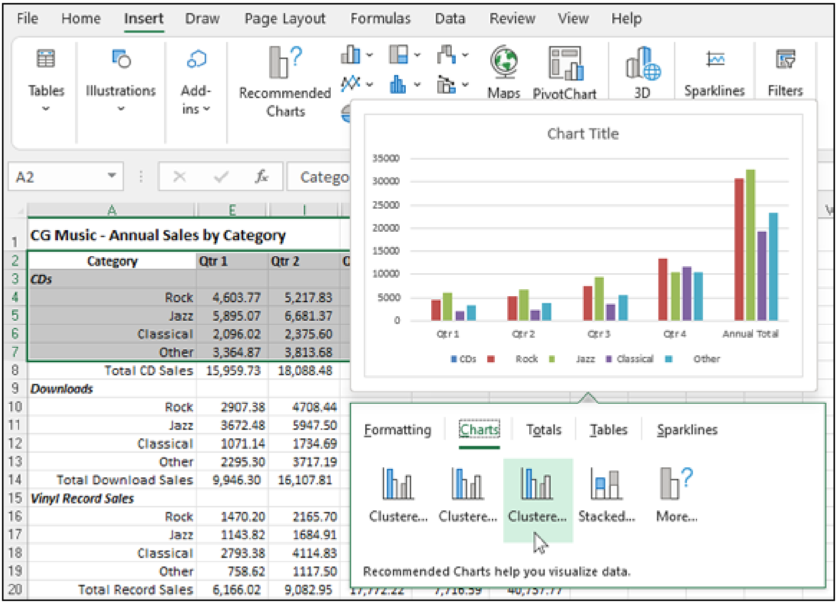
1. **Select the data you want to chart.**
2. **Click the Quick Analysis tool that appears at the lower-right corner of the selected range, then click the Charts tab at the top of the Quick Analysis options palette.**

   Excel displays buttons for different types of charts that suit the selected data, such as Column, Stacked Bar, and Clustered Bar, followed by a More button. The different types of chart buttons preview the selected data in that kind of chart. The final More button opens the Insert Chart dialog box with the Recommended Charts tab selected. Here you can preview and select a chart from an even wider range of chart types.
3. **To preview each type of chart that Excel can create using the selected data, hover the mouse pointer over the chart type button in the Quick Analysis palette.**

   As you hover over each chart type, Excel's Live Preview feature displays a large thumbnail of the chart that will be created from your table data. Figure 1-4 shows an example (sample workbook: CG Music with Chart Sheet.xlsx). This thumbnail appears above the Quick Analysis options palette for as long as the mouse or Touch pointer is over its corresponding button.

4. **Click the chart type you want to use.**

   Excel then creates and inserts an embedded chart of the selected type in the current worksheet. This embedded chart is active so that you can immediately move it and edit it as you wish.


File
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Help
Tables
Illustrations
Add-ins
Recommended Charts
Maps
PivotChart
3D
Sparklines
Filters
A2
Catego
Chart Title
35000
30000
25000
20000
15000
10000
5000
0
Qtr 1
Qtr 2
Qtr 3
Qtr 4
Annual Total
■ CDs ■ Rock ■ Jazz ■ Classical ■ Other
Formatting
Charts
Totals
Tables
Sparklines
Clustere...
Clustere...
Clustere...
Stacked...
More...

	A	E	I
1	CG Music - Annual Sales by Category		
2	Category	Qtr 1	Qtr 2
3	*CDs*		
4	Rock	4,603.77	5,217.83
5	Jazz	5,895.07	6,681.37
6	Classical	2,096.02	2,375.60
7	Other	3,364.87	3,813.68
8	Total CD Sales	15,959.73	18,088.48
9	*Downloads*		
10	Rock	2907.38	4708.44
11	Jazz	3672.48	5947.50
12	Classical	1071.14	1734.69
13	Other	2295.30	3717.19
14	Total Download Sales	9,946.30	16,107.81
15	*Vinyl Record Sales*		
16	Rock	1470.20	2165.70
17	Jazz	1143.82	1684.91
18	Classical	2793.38	4114.83
19	Other	758.62	1117.50
20	Total Record Sales	6,166.02	9,082.95

Recommended Charts help you visualize data.

FIGURE 1-4: Previewing the embedded chart to insert from the Quick Analysis tool. (Sample workbook: CG Music with Chart Sheet.xlsx)

Creating a chart on a separate chart sheet

Sometimes you know you want your new chart to appear on its own separate sheet in the workbook, and you don't have time to fool around with moving an embedded chart to its own sheet. In such a situation, position the cell pointer somewhere in the range of data to be graphed (or select the specific cell range in a larger range) and then press F11.

Excel creates a clustered column chart using the range data or cell selection on its own chart sheet (named Chart1 for the first chart sheet, then Chart 2, Chart 3, and so on) as shown in Figure 1-5 (sample workbook: CG Music with Chart Sheet.xlsx). You can then customize the chart on the new chart sheet as you would an embedded chart that's described later in the chapter.

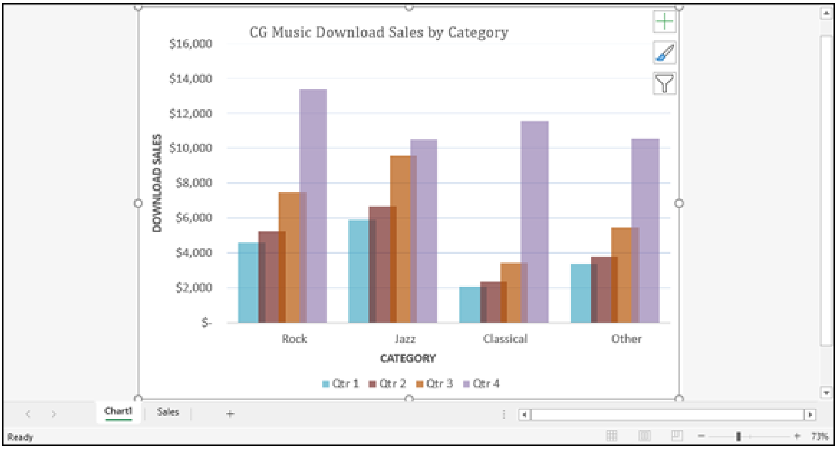

CG Music Download Sales by Category
DOWNLOAD SALES
$16,000
$14,000
$12,000
$10,000
$8,000
$6,000
$4,000
$2,000
$-
Rock
Jazz
Classical
Other
CATEGORY
Qtr 1
Qtr 2
Qtr 3
Qtr 4
Chart1
Sales
Ready
73%

FIGURE 1-5: Clustered column chart created on its own chart sheet. (Sample workbook: CG Music with Chart Sheet.xlsx)

Refining the chart from the Chart Design tab

When you click a chart to select it, you can use the tools on the Chart Design contextual tab to make all kinds of changes to your new chart. This tab contains the following groups:

- **Chart Layouts:** Click the Add Chart Element button to select the type of chart element you want to add. (You can also do this by selecting the Chart Elements button in the upper-right corner of the chart itself.) Click the Quick Layout button and then click the thumbnail of the new layout style you want applied to the selected chart on the drop-down gallery.
- **Chart Styles:** Click the Change Colors button to open a drop-down gallery and then select a new color scheme for the data series in the selected chart. In the Chart Styles gallery, highlight and then click the thumbnail of the new chart style you want applied to the selected chart. Note that you can select a new color and chart style in the opened galleries by clicking the Chart Styles button in the upper-right corner of the chart itself.

- **Data:** Click Switch Row/Column to immediately interchange the worksheet data used for the Legend Entries (Series) with that used for the Axis Labels (Categories) in the selected chart. Click Select Data to open the Select Data Source dialog box, where you can not only modify which data is used in the selected chart but also interchange the Legend Entries (Series) with the Axis Labels (Categories), but also edit, delete, or add particular entries to either category.
- **Type:** Click Change Chart Type to change the type of chart and then click the thumbnail of the new chart type on the All Charts tab in the Change Chart dialog box, which shows all kinds of charts in Excel.
- **Location:** Click Move Chart to open the Move Chart dialog box, where you move an embedded chart to its own chart or move a chart on its own sheet to one of the worksheets in the workbook as an embedded chart.

Modifying the chart layout and style

As soon as Excel draws a new chart in your worksheet, the program selects your chart and adds the Chart Design contextual tab. You can then use the Quick Layout and Chart Styles galleries to further refine the new chart.

Figure 1-6 (sample workbook: CG Music with Chart Sheet.xlsx) shows the original clustered column chart (created in Figure 1-5) after selecting Layout 9 on the Quick Layout button’s drop-down gallery and then selecting the Style 8 thumbnail on the Chart Styles drop-down gallery. Selecting Layout 9 adds Axis Titles to both the vertical and horizontal axes as well as creating the Legend on the right side of the graph. Selecting Style 8 gives the clustered column chart its dark background and contoured edges on the clustered columns themselves.

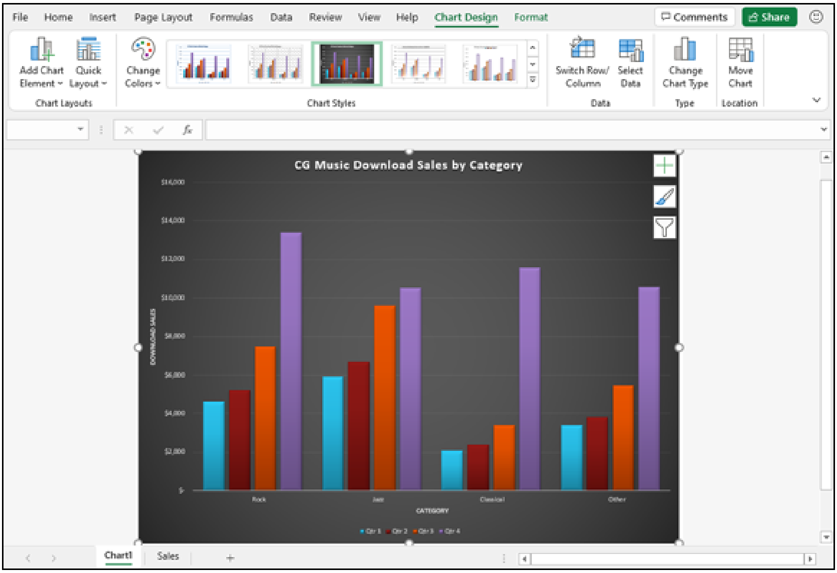

File
Home
Insert
Page Layout
Formulas
Data
Review
View
Help
Chart Design
Format
Comments
Share
Add Chart Element
Quick Layout
Change Colors
Chart Layouts
Chart Styles
Switch Row/ Column
Select Data
Data
Change Chart Type
Type
Move Chart
Location
CG Music Download Sales by Category
$16,000
$14,000
$12,000
$10,000
$8,000
$6,000
$4,000
$2,000
$-
DOWNLOAD SALES
Rock
Jazz
Classical
Other
CATEGORY
Qtr 1
Qtr 2
Qtr 3
Qtr 4
Chart1
Sales

FIGURE 1-6: Clustered column chart on its own chart sheet after selecting a new layout and style from the Design tab. (Sample workbook: CG Music with Chart Sheet.xlsx)

TIP

TRYING ON ALL YOUR CHOICES IN THE CHART STYLES GALLERY

When using the Chart Styles gallery to select a new style for your chart, you can display all the style choices by clicking that gallery's More button (the one with the horizontal bar directly over a triangle pointing downward). Doing this displays the thumbnails of all your layout and style choices for the new chart. You can also scroll through the rows of style choices by clicking the Previous Row or Next Row buttons immediately above it with the respective upward- or downward-pointing triangles.

Switching the rows and columns in a chart

Normally when Excel creates a new chart, it automatically graphs the data by rows in the cell selection so that the column headings appear along the horizontal (category) axis at the bottom of the chart and the row headings appear in the legend (assuming that you're dealing with a chart type that utilizes an *x*- and *y*-axis).

Select the chart to display the Chart Design contextual tab, and then click the Switch Row/Column command to switch the chart so that row headings appear on the horizontal (category) axis and the column headings appear in the legend (or you can press Alt+JCW).

Figure 1-7 (sample workbook: CG Music with Chart Sheet.xlsx) demonstrates how this works. This figure shows the clustered column chart from Figure 1-5 after selecting the Switch Row/Column command button on the Design tab. Now, column headings (Qtr 1, Qtr 2, Qtr 3, and Qtr 4) are used in the legend on the right and the row headings (Genre, Rock, Jazz, Classical, and Other) appear along the horizontal (category) axis.

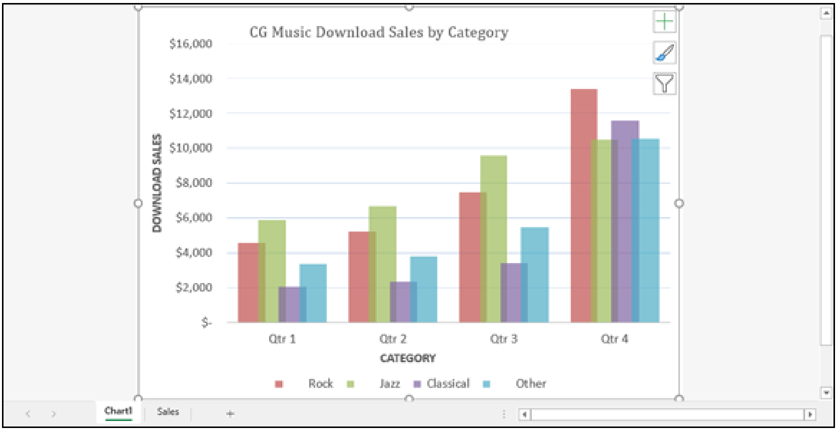

CG Music Download Sales by Category
DOWNLOAD SALES
$16,000
$14,000
$12,000
$10,000
$8,000
$6,000
$4,000
$2,000
$-
Qtr 1
Qtr 2
Qtr 3
Qtr 4
CATEGORY
Rock
Jazz
Classical
Other
Chart1
Sales

FIGURE 1-7: The clustered column chart after switching the columns and rows. (Sample workbook: CG Music with Chart Sheet.xlsx)

Editing the source of the data graphed in the chart

When you select the chart to display the Chart Design contextual tab and then click the Select Data command (or press Alt+JCE), Excel opens the Select Data Source dialog box similar to the one shown in Figure 1-8 (sample workbook: CG Music with Chart Sheet.xlsx), which corresponds to the chart layout shown earlier in Figure 1-5. The controls in this dialog box enable you to make the following changes to the source data:

- Modify the range of data being graphed in the chart by clicking the Chart Data Range text box and then making a new cell selection in the worksheet or typing in its range address.

- Switch the row and column headings back and forth by clicking its Switch Row/Column button.
- Edit the labels used to identify the data series in the legend or on the horizontal (category) by clicking the Edit button on the Legend Entries (Series) or Horizontal (Categories) Axis Labels side and then selecting the cell range with appropriate row or column headings in the worksheet.
- Add additional data series to the chart by clicking the Add button on the Legend Entries (Series) side and then selecting the cell containing the heading for that series in the Series Name text box and the cells containing the values to be graphed in that series in the Series Values text box.
- Delete a label from the legend by clicking its name in the Legend Entries (Series) list box and then clicking the Remove button.
- Modify the order of the data series in the chart by clicking the series name in the Legend Entries (Series) list box and then clicking the Move Up button (the one with the arrow pointing upward) or the Move Down button (the one with the arrow pointing downward) until the data series appears in the desired position in the chart.
- Indicate how to deal with empty cells in the data range being graphed by clicking the Hidden and Empty Cells button and then selecting the appropriate Show Empty Cells As option button (Gaps, the default; Zero or Connect Data Points with Line, for line charts). Click the Show Data in Hidden Rows and Columns check box to have Excel graph data in the hidden rows and columns within the selected chart data range.

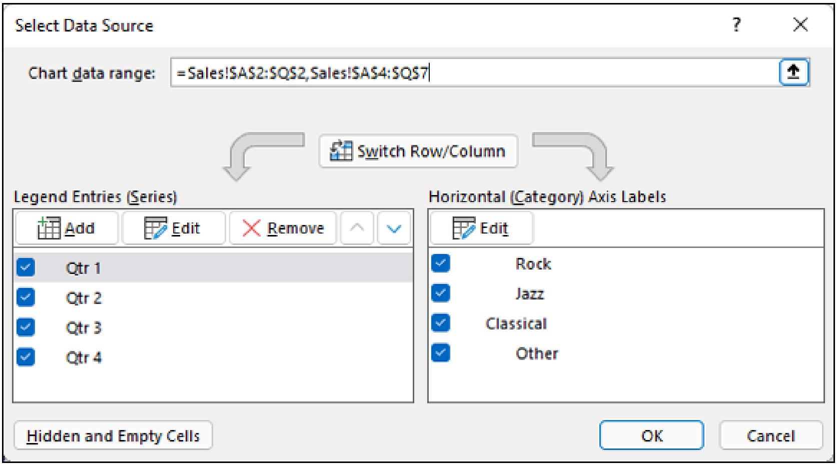

Select Data Source
?
Switch Row/Column
Legend Entries (Series)
Add
Edit
Remove
Horizontal (Category) Axis Labels
Edit
Hidden and Empty Cells
OK
Cancel

Chart data range: =Sales!$A$2:$Q$2,Sales!$A$4:$Q$7

☑ Qtr 1
☑ Qtr 2
☑ Qtr 3
☑ Qtr 4

☑ Rock
☑ Jazz
☑ Classical
☑ Other

FIGURE 1-8: Using the Select Data Source dialog box to remove the empty Genre label from the legend of the clustered column chart. (Sample workbook: CG Music with Chart Sheet.xlsx)

Customizing chart elements from the Format tab

When you select a chart, Excel displays the Format contextual tab, which offers tools for customizing the elements of your chart. Table 1-2 shows you the options that appear on the Format tab. Note that depending on the type of chart that's selected at the time, some of these options may be unavailable.

Customizing the elements of a chart

The Chart Elements button (with the plus sign icon) that appears in the upper-right corner of your chart when it's selected contains a list of the major chart elements that you can add to your chart. To add a particular element missing from the chart, select the element's check box in the list to put a check mark in it. To remove a particular element currently displayed in the chart, deselect the element's check box to remove its check mark.

TECHNICAL STUFF

ADDING HIDDEN ROWS AND

COLUMNS OF DATA TO A CHART

If you have hidden rows or columns in your data, Excel excludes that data from the chart. If you decide that you want to see the hidden data in the chart, all you have to do is open the Select Data Source dialog box (by clicking the Chart Design tab's Select Data button) and then click its Hidden and Empty Cells command button. Excel then opens a Hidden and Empty Cell Settings dialog box, where you select the Show Data in Hidden Rows and Columns check box and then click OK. Excel then immediately redraws the chart adding your hidden rows and columns.

TABLE 1-2 Format Tab Options

Tab Name	*Click This Tool To*
Chart Elements	Select a chart element by choosing its name from the button's drop-down menu.
Format Selection	Open a Format task pane for the currently selected chart element as displayed on the Chart Elements drop-down list button.
Reset to Match Style	Remove all custom formatting from the selected chart and return it to the original formatting bestowed by the style selected for the chart.
Insert Shapes Gallery	Add shapes to your chart from the drop-down gallery with a whole bunch of preset graphic shapes. (See Book 5, Chapter 2 for details.)
Change Shape	This command is disabled in this context.
Shape Styles	Display a drop-down gallery in which you can preview and select new colors and shapes for the currently selected chart element as displayed on the Chart Elements drop-down list button.
Shape Fill	Display a drop-down color palette in which you can preview and select a new fill color for the currently selected chart element as displayed on the Chart Elements drop-down list button.
Shape Outline	Display a drop-down color palette in which you can preview and select an outline color for the currently selected chart element as displayed on the Chart Elements drop-down list button.
Shape Effects	Display a drop-down menu containing a variety of graphics effect options (including Shadow, Glow, Soft Edges, Bevel, and 3-D Rotation), many of which have their own pop-up palettes that allow you to preview their special effects, where you can select a new graphics effect for the currently selected chart element as displayed on the Chart Elements drop-down list button.
WordArt Styles Quick Styles	Display drop-down WordArt gallery in which you can preview and select a new WordArt text style for the titles selected in the chart. If the Chart Area is the currently selected chart element as displayed on the Chart Elements drop-down list button, the program applies the WordArt style you preview or select to all titles in the chart.
Text Fill	Display a drop-down color palette in which you can preview and select a new text fill color for the titles selected in the chart. If the Chart Area is the currently selected chart element as displayed on the Chart Elements drop-down list button, the program applies the WordArt style you preview or select to all titles in the chart. You can also select an image to be used as the text fill rather than a color by selecting the Picture option below the color palette.
Text Outline	Display drop-down color palette in which you can preview and select a new text outline color for the titles selected in the chart. If the Chart Area is the currently selected chart element as displayed on the Chart Elements drop-down list button, the program applies the WordArt style you preview or select to all titles in the chart.
Text Effects	Display drop-down menu with the Shadow, Reflection, Glow, Bevel, 3-D Rotation,

		and Transform graphics effect options active, each of which have their own pop-up palettes that you can use to preview and select special effects for the titles selected in the chart. If the Chart Area is the currently selected chart element as displayed on the Chart Elements drop-down list button, the program applies the WordArt style you preview or select to all titles in the chart.
Accessibility	Alt Text	Display the Alt Text task pane, in which you can add alternative text that describes the purpose and results of the chart for reviewers who use a screen reader. (See Book 4, Chapter 3 for more.)
Arrange	Bring Forward	Move the object to a higher layer in the stack or choose the Bring to Front option from the button's drop-down menu to bring the selected embedded chart or other graphic object to the top of its stack. (See Book 5, Chapter 2 for details.)
	Send Backward	Move the object to a lower level in the stack or choose the Send to Back option from the button's drop-down menu to send the selected embedded chart or other graphic object to the bottom of its stack. (See Book 5, Chapter 2 for details.)
	Selection Pane	Display and hide the Selection and Visibility task pane that shows all the graphic objects in the worksheet and enables you to hide and redisplay them as well as promote or demote them to different layers. (See Book 5, Chapter 2 for details.)
	Align	Display a drop-down menu that enables you to snap the selected chart to an invisible grid on another graphic object as well as to choose between a number of different alignment options when multiple graphic objects are selected. (See Book 5, Chapter 2 for details.)
	Group	This command is disabled in this context.
	Rotate	This command is disabled in this context.
Size	Shape Height	Modify the height of the selected embedded chart by typing a new value in it or selecting one with the spinner buttons.
	Shape Width	Modify the width of the selected embedded chart by typing a new value in it or selecting one with the spinner buttons.

To add or remove just part of a particular chart element or, in some cases as with the Chart Title, Data Labels, Data Table, Error Bars, Legend, and Trendline, to also specify its layout, you select the desired option on the element's continuation menu. Figure 1-9 (sample workbook: CG Music with Chart Sheet.xlsx) shows the layout options for the Legend element.

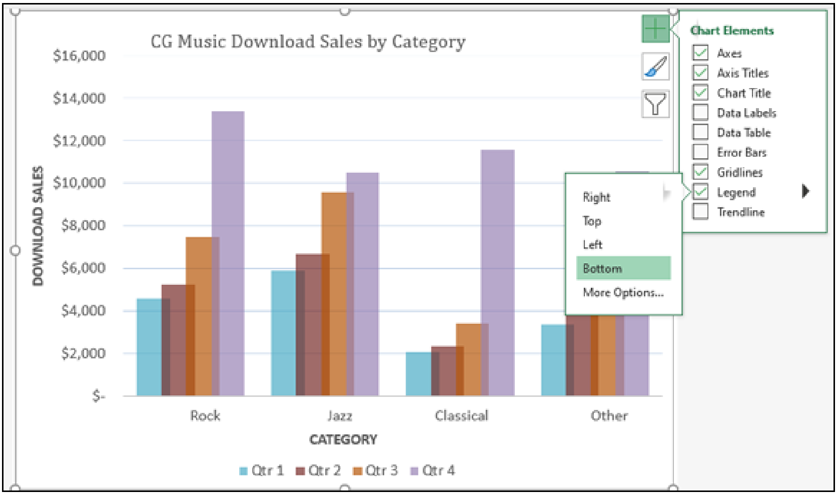

CG Music Download Sales by Category
DOWNLOAD SALES
$16,000
$14,000
$12,000
$10,000
$8,000
$6,000
$4,000
$2,000
$-
Rock
Jazz
Classical
Other
CATEGORY
Qtr 1
Qtr 2
Qtr 3
Qtr 4
Right
Top
Left
Bottom
More Options...
Chart Elements
☑ Axes
☑ Axis Titles
☑ Chart Title
☐ Data Labels
☐ Data Table
☐ Error Bars
☑ Gridlines
☑ Legend
☐ Trendline

FIGURE 1-9: Repositioning the chart legend in the example clustered column using the Chart Elements Legend item. (Sample workbook: CG Music with Chart Sheet.xlsx)

So, for example, to reposition a chart's legend, you click the continuation button attached to Legend on the Chart Elements menu to display and select from among the following options on its continuation menu:

- **Right:** Positions the legend so that it appears to the right of the plot area
- **Top:** Positions the legend so that it appears above the plot area
- **Left:** Positions the legend so that it appears to the left of the plot area
- **Bottom:** Positions the legend so that it appears below the plot area
- **More Options:** Opens the Format Legend task pane on the right side of the Excel window so you can use the options that appear to modify almost any aspect of the legend's formatting.

Adding data labels to the series in a chart

Data labels identify the data points in your chart (that is, the columns, lines, and so forth used to graph your data) by displaying values from the cells of the worksheet represented next to them. To add data labels to your selected chart and position them, click the Chart Elements button next to the chart and then select the Data Labels check box before you select one of the following options on its continuation menu:

- **Center** to position the data labels in the middle of each data point
- **Inside End** to position the data labels inside each data point near the end
- **Inside Base** to position the data labels at the base of each data point
- **Outside End** to position the data labels outside of the end of each data point
- **Data Callout** to add text labels as well as values that appear within text boxes that point to each data point
- **More Options** to open the Format Data Labels task pane on the right side where you can use the options that appear when you select the Fill & Line, Effects, Size & Properties, and Label Options buttons under Label Options and the Text Fill & Outline, Text Effects, and Textbox buttons under Text Options in the task pane to customize almost any aspect of the appearance and position of the data labels

REMEMBER To remove all data labels from the data points in a selected chart, clear the Data Labels check box on the Chart Elements menu.

Adding a data table to a chart

Sometimes, instead of data labels that can easily obscure the data points in the chart, you'll want Excel to draw a data table beneath the chart showing the worksheet data it represents in graphic form.

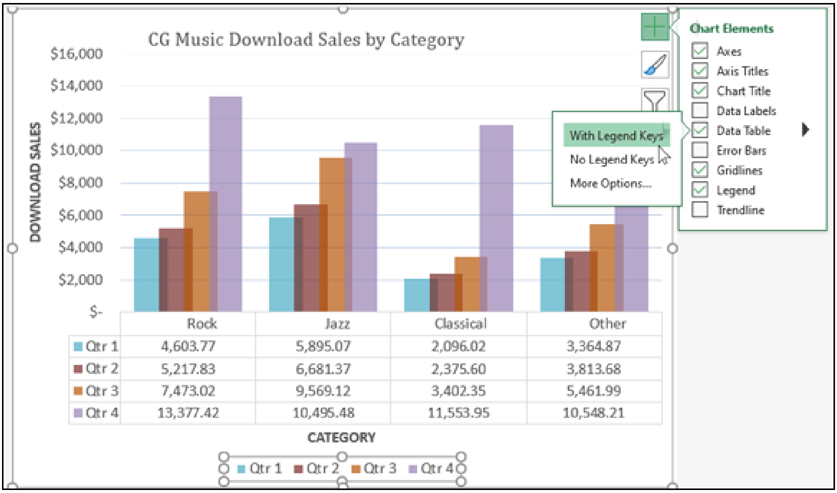
To add a data table to your selected chart and position and format it, click the Chart Elements button next to the chart and then select the Data Table check box before you select one of the following options on its continuation menu:

- **With Legend Keys** to have Excel draw the table at the bottom of the chart, including the color keys used in the legend to differentiate the data series in the first column
- **No Legend Keys** to have Excel draw the table at the bottom of the chart without any legend
- **More Options** to open the Format Data Table task pane on the

right side where you can use the options that appear when you select the Fill & Line, Effects, Size & Properties, and Table Options buttons under Table Options and the Text Fill & Outline, Text Effects, and Textbox buttons under Text Options in the task pane to customize almost any aspect of the data table

Figure 1-10 (sample workbook: CG Music with Chart Sheet.xlsx) illustrates how the sample clustered column chart (introduced in Figure 1-5) looks with a data table added to it. This data table includes the legend keys as its first column.

REMEMBER If you decide that having the worksheet data displayed in a table at the bottom of the chart is no longer necessary, click to deselect the Data Table check box on the Chart Elements menu.


CG Music Download Sales by Category
DOWNLOAD SALES
$16,000
$14,000
$12,000
$10,000
$8,000
$6,000
$4,000
$2,000
$-
CATEGORY
■ Qtr 1 ■ Qtr 2 ■ Qtr 3 ■ Qtr 4
With Legend Keys
No Legend Keys
More Options...
Chart Elements
☑ Axes
☑ Axis Titles
☑ Chart Title
☐ Data Labels
☑ Data Table
☐ Error Bars
☑ Gridlines
☑ Legend
☐ Trendline

	Rock	Jazz	Classical	Other
■ Qtr 1	4,603.77	5,895.07	2,096.02	3,364.87
■ Qtr 2	5,217.83	6,681.37	2,375.60	3,813.68
■ Qtr 3	7,473.02	9,569.12	3,402.35	5,461.99
■ Qtr 4	13,377.42	10,495.48	11,553.95	10,548.21

FIGURE 1-10: Clustered column chart on its own Chart sheet with data table and legend keys. (Sample workbook: CG Music with Chart Sheet.xlsx)

Editing the chart titles

When Excel first adds any title to a new chart, the program gives it a generic name, such as Chart Title or AXIS TITLE (for both the *x*- and *y*-axis title). To replace such generic titles with the actual chart titles, click the title in the chart or click the name of the title on the Chart Elements drop-down list. (Chart Elements is the first drop-down button in the Current Selection group on the Format contextual tab. Its text box displays the name of the element currently selected in the chart.) Excel lets you know that a particular chart title is selected by placing selection handles around its perimeter.

After selecting a title, you can then click the insertion point in the text and then edit as you would any worksheet text, or you can triple-click to select the entire title and completely replace it with the text you type. To force part of the title onto a new line, click the insertion point at the place in the text where the line break is to occur. After the insertion point is positioned in the title, press Enter to start a new line. After you finish editing the title, click somewhere else on the chart area to deselect it (or a worksheet cell, if you've finished formatting and editing the chart).

Double-click anywhere in a word in the chart title to completely select that word. Triple-click anywhere in the title text to completely select that chart title. When you double- or triple-click a chart title, a mini-bar appears above the title with buttons for modifying the selected text's font, font size, and alignment, as well as for adding text enhancements such as bold, italic, and underlining.

TIP

If you want, you can instantly create a title for your chart by linking it to a heading that's been entered into one of the cells in your worksheet. That way, if you update the heading in the worksheet, it's automatically updated in your chart. To link a chart title to a heading in a worksheet cell, click the title in the chart to select it, then type = on the Formula bar, click the cell in the worksheet that contains the text you want to use as the chart title, and press Enter. Excel shows that the chart title is now dynamically linked to the contents of the cell by displaying its absolute cell reference whenever that title is selected in the chart.

Formatting elements of a chart

Excel offers you several methods for formatting particular elements of any chart that you create. The most direct way is to right-click the chart element (title, plot area, legend, data series, and so forth) in the chart itself. Excel displays a mini-bar with options such as Fill, Outline, and (in the case of chart titles), Style. You can then use the drop-down galleries and menus attached to these buttons to connect the selected chart element.

If the mini-bar formatting options aren't sufficient for the kind of changes you want to make to a particular chart element, you can open a task pane for the element. The easiest way to do this is by right-clicking the element in the chart and then selecting the Format option at the bottom of the shortcut menu that appears. This Format option, like the task pane that opens on the right side of the worksheet window, is followed by the name of the element selected so that when the Chart Title is selected, this menu option is called Format Chart Title, and the task pane that opens when you select this option is labeled Format Chart Title, as shown in Figure 1-11 (sample workbook: CG Music with Chart Sheet.xlsx).

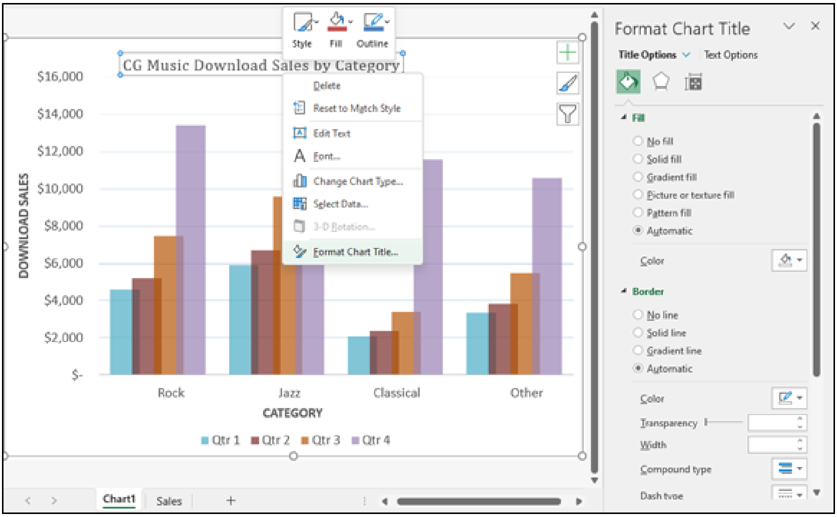

Style
Fill
Outline
CG Music Download Sales by Category
$16,000
$14,000
$12,000
$10,000
$8,000
$6,000
$4,000
$2,000
$-
DOWNLOAD SALES
Rock
Jazz
Classical
Other
CATEGORY
Qtr 1
Qtr 2
Qtr 3
Qtr 4
Delete
Reset to Match Style
Edit Text
Font...
Change Chart Type...
Select Data...
3-D Rotation...
Format Chart Title...
Chart1
Sales
Format Chart Title
Title Options
Text Options
Fill
No fill
Solid fill
Gradient fill
Picture or texture fill
Pattern fill
Automatic
Color
Border
No line
Solid line
Gradient line
Automatic
Color
Transparency
Width
Compound type
Dash type

FIGURE 1-11: Formatting the Chart Title with the options in the Format Chart Title task pane. (Sample workbook: CG Music with Chart Sheet.xlsx)

The element's task pane contains groups of options, often divided into two categories: Options for the selected element on the left — such as Title Options in the Format Chart Title task pane or Legend Options in the Format Legend task pane — and Text Options on the right. Each group, when selected, then displays its own cluster of buttons and each button, when selected has its own collection of formatting options, often displayed only when expanded by clicking the option name.

TIP You can click the drop-down button found to the immediate right of any Options group in any Format task pane to display a drop-down menu with a complete list of all the elements in that chart. To select another element for formatting, select its name from this drop-down list. Excel then selects that element in the chart and switches to its Format task pane so that you have access to all its groups of formatting options.

REMEMBER The Format contextual tab also contains a Shape Styles and WordArt Styles group of command buttons that you can sometimes use to format the element you've selected in the chart. Table 1-2, shown earlier in this chapter, gives you the lowdown on the command buttons in these groups on the Format tab.

Formatting chart titles with the Format Chart Title task pane

When you choose the Format Chart Title option from a chart title's shortcut menu, Excel displays a Format Chart Title task pane similar to the one shown in Figure 1-11. The Title Options group is automatically selected as is the Fill & Line button (with the paint can icon).

As shown in Figure 1-11, there are two groups of Fill & Line options: Fill and Border (neither of whose particular options are initially displayed when you first open the Format Chart Title task pane — in this figure, I clicked both Fill and Border so that you could see all of the Fill options and the first part of the Border options). Next to the Line & Fill button is the Effects button (with the pentagon icon). This button has four groups of options associated with it: Shadow, Glow, Soft Edges, and 3-D Format.

You would use the formatting options associated with the Fill & Line and Effects buttons in the Title Options group when you want to change the look of the text box that contains the selected chart title. More likely when formatting most chart titles, you will want to use the commands found in the Text Options group to actually change the look of the title text.

When you click Text Options in the Format Chart Title task pane, you find three buttons with associated options:

- **Text Fill & Outline** (with a filled A with an outlined underline at the bottom icon): When selected, it displays a Text Fill and Text Outline groups of options in the task pane for changing the type and color of the text fill and the type of outline.
- **Text Effects** (with the outlined A with a circle at the bottom icon): When selected, it displays a Shadow, Reflection, Glow, Soft Edges, and 3-D Format and 3-D Rotation groups of options in the task pane for adding shadows to the title text or other special effects.
- **Textbox** (with the A in the upper-left corner of a text box icon): When selected, it displays a list of Text Box options for controlling the vertical alignment, text direction (especially useful when formatting the Vertical [Value] Axis title), and angle of the text box containing the chart title. It also includes options for resizing the shape to fit the text and how to control any text that overflows the text box shape.

Formatting chart axes with the Format Axis task pane

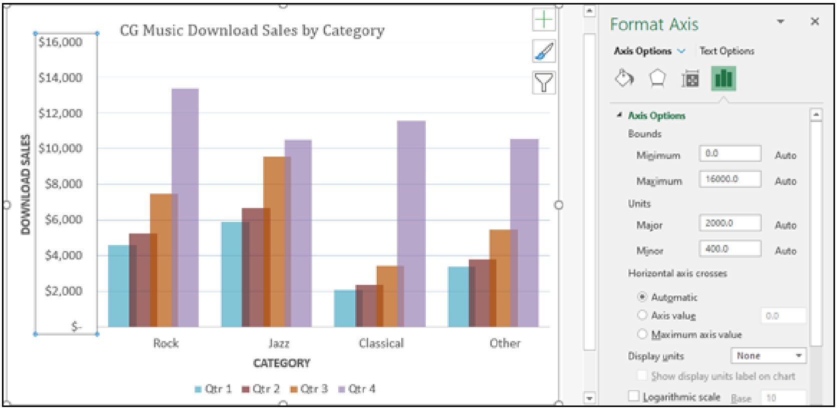
The axis is the scale used to plot the data for your chart. Most chart types have axes. All 2-D and 3-D charts have an *x*-axis known as the horizontal axis and a *y*-axis known as the vertical axis with the exception of pie charts and radar charts. The horizontal *x*-axis is also referred to as the category axis and the vertical *y*-axis as the value axis except in the case of XY (Scatter) charts, where the horizontal *x*-axis is also a value axis just like the vertical *y*-axis because this type of chart plots two sets of values against each other.

When you create a chart, Excel sets up the category and values axes for you automatically, based on the data you are plotting. You can then adjust the axes in various ways. The most common ways you will want to modify the category axis of a chart is to modify the interval between its tick marks and where it crosses the value axis in the chart. The most common ways you will want to modify a value axis of a chart is to change the scale that it uses and assign a new number formatting to its units.

To make such changes to a chart axis in the Format Axis task pane, right-click the axis in the chart and then select the Format Axis option at the very bottom of its shortcut menu. Excel opens the Format Axis task pane with the Axis Options group selected, displaying its four command buttons: Fill & Line, Effects, Size & Properties, and Axis Options. You then select the Axis Options button (with the clustered column data series icon) to display its four groups of options: Axis

Options, Tick Marks, Labels, and Number.

Then, click Axis Options to expand and display its formatting options for the particular type of axis selected in the chart. Figure 1-12 (sample workbook: CG Music with Chart Sheet.xlsx) shows the formatting options available when you expand this and the vertical (value) or *y*-axis is selected in the sample chart.


CG Music Download Sales by Category
DOWNLOAD SALES
$16,000
$14,000
$12,000
$10,000
$8,000
$6,000
$4,000
$2,000
$-
Rock
Jazz
Classical
Other
CATEGORY
Qtr 1
Qtr 2
Qtr 3
Qtr 4
Format Axis
Axis Options
Text Options
Axis Options
Bounds
Units
Horizontal axis crosses

Minimum 0.0 Auto

Maximum 16000.0 Auto

Major 2000.0 Auto

Minor 400.0 Auto

● Automatic

○ Axis value 0.0

○ Maximum axis value

Display units None

☐ Show display units label on chart

☐ Logarithmic scale Base 10

FIGURE 1-12: Formatting the Vertical (Value) Axis with the options in the Format Axis task pane. (Sample workbook: CG Music with Chart Sheet.xlsx)

The Axis Options for formatting the Vertical (Value) Axis include:

- **Bounds** to determine minimum and maximum points of the axis scale. Use the Minimum option to reset the point where the axis begins — perhaps $4,000 instead of the default of $0 — by entering a value higher than 0.0 in its text box. Use the Maximum to determine the highest point displayed on the vertical axis entering the new maximum value in its text box. Note that data values in the chart greater than the value you specify here aren't displayed in the chart.
- **Units** to change the units used in separating the tick marks on the axis. Use the Major option to modify the distance between major horizontal tick marks (assuming they're displayed) in the chart by entering the number of the new distance in its text box. Use the Minor option to modify the distance between minor horizontal tick marks (assuming they're displayed) in the chart by entering the number of the new distance in its text box.
- **Horizontal Axis Crosses** to reposition the point at which the horizontal axis crosses the vertical axis by clicking the Axis Value

option button and then entering the value in the chart at which the horizontal axis is to cross or by clicking the Maximum Axis Value option button to have the horizontal axis cross after the highest value, putting the category axis labels at the top of the chart's frame.

- **Logarithmic Scale** to base the value axis scale upon powers of ten and recalculate the Minimum, Maximum, Major Unit, and Minor Unit accordingly by selecting its check box to put a check mark in it. Enter a new number in its text box if you want the logarithmic scale to use a base other than 10.
- **Values in Reverse Order** to place the lowest value on the chart at the top of the scale and the highest value at the bottom (as you may want to do in a chart to emphasize the negative effect of the larger values) by selecting its check box to put a check mark in it.

The Axis Options for formatting the Horizontal (Category) Axis include

- **Axis Type** to indicate for formatting purposes that the axis labels are text entries by clicking the Text Axis option button or indicate that they are dates by clicking the Date Axis option button.
- **Vertical Axis Crosses** to reposition the point at which the vertical axis crosses the horizontal axis by clicking the At Category Number option button. Then enter the number of the category in the chart (with 1 indicating the leftmost category) after which the vertical axis is to cross or by clicking the At Maximum option button to have the vertical axis cross after the very last category on the right edge of the chart's frame.
- **Axis Position** to reposition the horizontal axis so that its first category is located at the vertical axis on the left edge of the chart's frame and the last category is on the right edge of the chart's frame by selecting the On Tick Marks option button rather than between the tick marks (the default setting).
- **Categories in Reverse Order** to reverse the order in which the data markers and their categories appear on the horizontal axis by clicking its check box to put a check mark in it.

The Tick Marks options in the Format Axis task pane include the following two options whether the Horizontal (Category) Axis or the Vertical (Value) Axis is selected:

- **Major Type** to change how the major horizontal or vertical tick marks intersect the opposite axis by selecting the Inside, Outside, or Cross option from its drop-down list.

- **Minor Type** to change how the minor horizontal or vertical tick marks intersect the opposite axis by selecting the Inside, Outside, or Cross option from its drop-down list.

Note that when modifying the Horizontal (Category) Axis, Excel offers an Interval Between Marks Tick Marks option that enables you to change the span between the tick marks that appear on this x-axis.

In addition to changing *y*- and *x*-axis formatting settings with the options found in the Axis Options and Tick Marks sections in the Format Axis task pane, you can modify the position of the axis labels with the Label Position option under Labels and number formatting assigned to the values displayed in the axis with Category option under Number.

To reposition the axis labels, click Labels in the Format Axis task pane to expand and display its options. When the Vertical (Value) Axis is the selected chart element, you can use the Label Position option to change the position to left of the chart's plot area by selecting the Low option, to right of the chart's plot area by selecting the High option, or to completely remove their display in the chart by selecting the None option on its drop-down list.

When the Horizontal (Category) Axis is selected, you can also specify the Interval between the Labels on this axis, specify their Distance from the Axis (in pixels), and even modify the Label Position with the same High (above the chart's plot area), Low (below the chart's plot area), and None options.

To assign a new number format to a value scale (General being the default), click Number in the Format Axis task pane to display its formatting options. Then, select the number format from the Category drop-down list and specify the number of decimal places and symbols (where applicable) as well as negative number formatting that you want applied to the selected axis in the chart.

Saving a customized chart as a template

After going through extensive editing and formatting of one of Excel’s basic chart types, you may want to save your work of art as a custom chart type that you can then use again with different data without having to go through all the painstaking steps to get the chart looking just the way you want it. Excel makes it easy to save any modified chart that you want to use again as a custom chart type.

To convert a chart on which you’ve done extensive editing and formatting into a custom chart type, you take these steps:

1. **Right-click the customized chart in the worksheet or on its chart sheet to select its chart area and display its shortcut menu.**

   You can tell that the chart area (as opposed to any specific element in the chart) is selected because the Format Chart Area option appears near the bottom of the displayed shortcut menu.

2. **Choose the Save As Template option from the shortcut menu.**

   Excel opens the Save Chart Template dialog box. The program automatically suggests `Chart1.crtx` as the filename, Chart Template Files (`*.crtx`) as the file type, and the Charts folder in the Microsoft Templates folder as the location.

3. **Edit the generic chart template filename in the File Name text box to give the chart template file a descriptive name without removing the `.crtx` filename extension.**
4. **Click the Save button to close the Save Chart Template dialog box.**

After creating a custom chart template in this manner, you can then use the template anytime you need to create a new chart that requires similar formatting by following these steps:

1. **Select the data in the worksheet to be graphed in a new chart using your chart template.**
2. **On the Insert tab, click the dialog box launcher in the lower-right corner of the Charts group.**

   The Insert Chart dialog box appears with the Recommended Charts tab selected.

3. **Click the All Charts tab and then select the Templates option in the Navigation pane of the Insert Chart dialog box.**

   Excel then displays thumbnails for all the chart templates you've saved in the main section of the

Create Chart dialog box. To identify these thumbnails by filename, position the mouse pointer over the thumbnail image.

4. **Click the thumbnail for the chart template you want to use to select it and then click OK.**

As soon as you click OK, Excel applies the layout and all the formatting saved as part of the template file to the new embedded chart created with the data in the current cell selection.

Adding Sparkline Graphics to a Worksheet

Excel supports a type of information graphic called sparklines that represents trends or variations in collected data. *Sparklines* — invented by Edward Tufte — are miniature charts designed to help you visualize nearby data in a worksheet. Sparklines are the height of the worksheet cells whose data they represent and can be any of following three chart types:

- **Line** that represents the selected worksheet data as a connected line showing whose vectors display their relative value
- **Column** that represents the selected worksheet data as tiny columns
- **Win/Loss** that represents the selected worksheet data as a win/loss chart whereby wins are represented by blue squares that appear above the red squares representing the losses

To add sparklines to the cells of your worksheet, you follow these general steps:

1. **Select the cells in the worksheet with the data you want represented by a sparkline.**
2. **In the Insert tab's Sparklines group, click the type of chart you want for your sparkline (Line, Column, or Win/Loss). Or press Alt+NSL for Line, Alt+NSO for Column, or Alt+NSW for Win/Loss.**

   Excel opens the Create Sparklines dialog box, which contains two text boxes: Data Range, which shows the cells you selected with the data you want graphed, and Location Range, where you designate the cell or cell range where you want the sparkline graphic to appear.

3. **Select the cell or range of cells where you want your sparkline to appear in the Location Range text box and then click OK.**

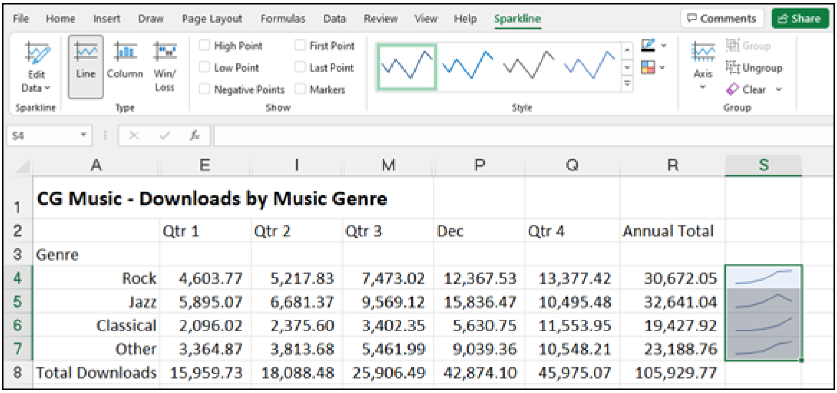
   When creating a sparkline that spans more than a single cell, the Location Range must match the Data Range in terms of the same amount of rows and columns. (In other words, they need to be ranges of equal size and shape.)

TIP

Because sparklines are so small, you can easily add them to the cells in the final column of a table of data. That way, the sparklines can depict the data visually and enhance their meaning while remaining an integral part of the table whose data they epitomize.

Figure 1-13 (sample workbook: CG Music Downloads.xlsx) shows you a worksheet data table after adding sparklines to the table's final column. These sparklines depict the variation in the sales over four quarters as tiny line graphs. As you can see in this figure, when you add sparklines to your worksheet, Excel adds a Sparkline contextual tab to the Ribbon.

The Sparkline tab contains buttons that you can use to edit the type, style, and format of the sparklines. The final group (called Group) enables you to band together a range of sparklines into a single group that can share the same axis and/or minimum or maximum values (selected using the options on its Axis drop-down button). This is very useful when you want a collection of different sparklines to all share the same charting parameters so that they equally represent the trends in the data.


File
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Help
Sparkline
Comments
Share
Edit Data
Sparkline
Line
Column
Win/Loss
Type
High Point
Low Point
Negative Points
First Point
Last Point
Markers
Show
Style
Axis
Group
Ungroup
Clear
Group
S4

	A	E	I	M	P	Q	R	S
1	**CG Music - Downloads by Music Genre**							
2		Qtr 1	Qtr 2	Qtr 3	Dec	Qtr 4	Annual Total	
3	Genre							
4	Rock	4,603.77	5,217.83	7,473.02	12,367.53	13,377.42	30,672.05	
5	Jazz	5,895.07	6,681.37	9,569.12	15,836.47	10,495.48	32,641.04	
6	Classical	2,096.02	2,375.60	3,402.35	5,630.75	11,553.95	19,427.92	
7	Other	3,364.87	3,813.68	5,461.99	9,039.36	10,548.21	23,188.76	
8	Total Downloads	15,959.73	18,088.48	25,906.49	42,874.10	45,975.07	105,929.77	

FIGURE 1-13: Sparklines graphics representing the variation in the data in a worksheet table as tiny Line charts. (Sample workbook: CG Music Downloads.xlsx)

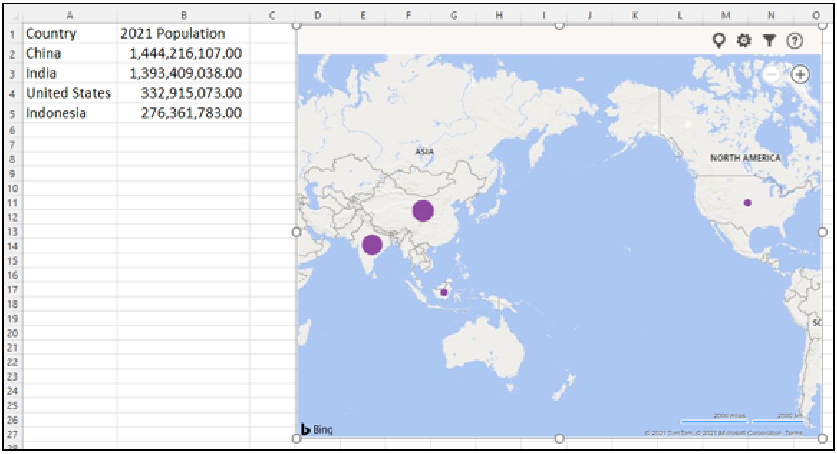
Adding Infographics to a Worksheet

Excel enables you to add basic infographics to your worksheets from the Insert tab of the Ribbon with the addition of Bing Maps and People Graph to the drop-down menu on its Add-Ins button, and the Filled Map option in its Maps button. These infographics enhancements enable you to create visual representations of regionally related worksheet data that can point out trends and quickly convey their most pertinent information.

All you need to add great-looking infographics to a worksheet is some geographically related data. The geographic regions that Excel automatically recognizes and can work with when creating infographics include

- Names of Countries, such USA, Russia, Canada, and so forth
- Names of Provinces, such as Manitoba, Ontario, British Columbia, and so forth
- Names of States, such as Maine, Connecticut, Florida, and so forth
- Two-letter state abbreviations, such CA, NY, IA, and so forth
- Postal codes, such as 94107, 78641, or SN13 9NH, WC2N 5DU, and the like

To demonstrate how to use Excel's infographics, I created a simple worksheet that contains two columns of data. The first column contains four country names (China, India, USA, and Indonesia) and the second contains associated population figures (from 2021 data). Figure 1-14 (sample workbook: 2021 Population Infographics.xlsx) shows the infographic that I created with the Bing Maps add-in for this data.



Country	2021 Population
China	1,444,216,107.00
India	1,393,409,038.00
United States	332,915,073.00
Indonesia	276,361,783.00

FIGURE 1-14: Adding a Bing Maps infographic to illustrate the 2021 population by country data in a worksheet. (Sample workbook: 2021 Population Infographics.xlsx)

To create this Bing Maps infographic, I followed these steps:

1. **Select the range with the population data (A1:B5).**
2. **On the Insert tab, choose Add-ins⇒ Bing Maps (or press Alt+NZ1A1).**

   If you see the Bing Maps dialog box, be sure to click Trust This Add-In to continue.

3. **Click the Show Locations button (the leftmost one in the top row) of the Welcome to Bing Maps graphic.**

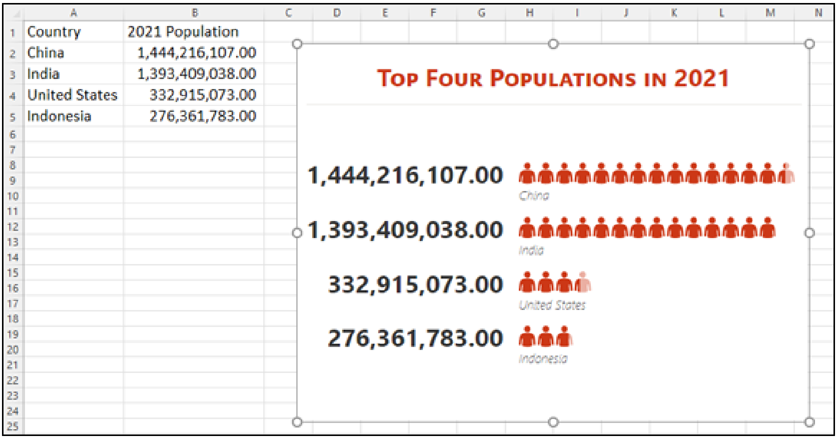
That’s all there is to it. Bing Maps automatically draws a 2-D map of the world including the four named countries and draws blue circles in each of them, representing the relative size of their populations (according to the values in the B column of the Excel data table). If I wanted to, I could then use the Settings button (the second one on the top row with the cog icon) to change the default formatting of the population infographic or even filter its data with the Filters button (the third one on the top row).

Figure 1-15 (sample workbook: 2021 Population Infographics.xlsx) shows the People Graph infographic created from the same population data table an Excel worksheet. To create this infographic, I followed these steps:

1. **Open the worksheet with the population data table.**
2. **Click the People Graph button on the drop-down menu attached to the Add-ins button on the Insert tab of the Ribbon (or press Alt+NZ1A2).**

   If you see the People Graph dialog box, be sure to click Trust This Add-In to continue.
3. **Click the Data button (the one with the tiny worksheet icon) at the top of the Numbers About the App default infographic.**

   When you click the Data button, a Data panel appears in the default infographic where you can select the data to be represented as well as change the title.
4. **Select the placeholder title text (Numbers About the App) in the Title text box and then replace it by entering your own title.**
5. **Click the Select Your Data button in the Data panel right above the Title text box and then drag through the cell range with the labels and values you want used in the new infographic.**
6. **Click the Create button.**



Country	2021 Population
China	1,444,216,107.00
India	1,393,409,038.00
United States	332,915,073.00
Indonesia	276,361,783.00

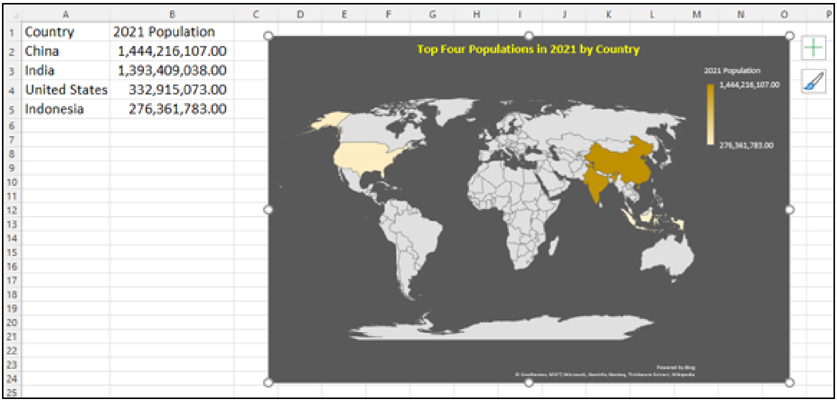
A
B
C
D
E
F
G
H
I
J
K
L
M
N
Top Four Populations in 2021
1,444,216,107.00
China
1,393,409,038.00
India
332,915,073.00
United States
276,361,783.00
Indonesia

FIGURE 1-15: Adding a People Graph infographic to illustrate the 2021 population by country data in a worksheet. (Sample workbook: 2021 Population Infographics.xlsx)

As soon as you click the Create button, the People Graph add-in replaces its default infographic with the title and Excel data you specified. You can then use its Settings button (the one with the cog icon) to modify its formatting if you so choose.

Figure 1-16 (sample workbook: 2021 Population Infographics.xlsx) shows the Filled Map chart created using the same population worksheet data as for the Bing Maps and People Graph infographics shown in Figures 1-14 and 1-15, respectively. This is the easiest of the three to create. All I had to do is position the cell cursor in one of the cells with the population data before clicking the Maps button on the Insert tab of the Ribbon.

Excel immediately created the Filled Map chart shown in Figure 1-16. All I then had to do was replace the Chart Title placeholder with the chart title shown in this figure.



Country	2021 Population
China	1,444,216,107.00
India	1,393,409,038.00
United States	332,915,073.00
Indonesia	276,361,783.00

FIGURE 1-16: Adding a Filled Map chart infographic to illustrate the 2021 population by country data in a worksheet. (Sample workbook: 2021 Population Infographics.xlsx)

Printing Charts

To print an embedded chart as part of the data on the worksheet, you print the worksheet from the Print Settings screen in the Backstage view by pressing Ctrl+P. To print an embedded chart by itself without the supporting worksheet data, click the chart to select it before you press Ctrl+P to open the Print screen in the Backstage view. In the Print screen, Print Selected Chart appears as the default selection in the very first drop-down list box under the Settings heading and a preview of the embedded chart appears in the Preview pane on the right.

To print a chart that's on a separate chart sheet in the workbook file, activate the chart sheet by clicking its sheet tab and then press Ctrl+P to open the Print panel, where Print Active Sheet(s) appears as the default selection for the Settings drop-down list box and the chart itself appears in the Preview pane on the right.

REMEMBER When you want to print an embedded chart alone — that is, without its supporting data or in its own chart sheet — you may want to select the print quality options on the Chart tab of the Page Setup dialog box (which you can open by clicking the Page Setup link in the Print screen in the Backstage view or by clicking the dialog box launcher on the Page Layout tab) before sending the chart to the printer. The Print Quality options on the Chart tab include the following:

- **Draft Quality:** Select this check box to print the chart using your printer's draft-quality setting.
- **Print in Black and White:** Select this check box to have your color printer print the chart in black and white.

Chapter 2

Adding Graphic Objects

IN THIS CHAPTER

- **Understanding what graphic objects are and how Excel treats them**
- **Managing graphic objects on the worksheet**
- **Adding online images to the worksheet**
- **Adding text boxes with arrows**
- **Inserting 2-D line art, icons, pictures, and 3-D model graphics in the worksheet**
- **Adding WordArt text and SmartArt diagrams to the worksheet**
- **Capturing screenshots of the Windows desktop as Excel graphics**
- **Applying graphic themes to the worksheet**

Just as charts can really help to clarify trends and implications that aren't readily apparent in your worksheet data, graphics that you add to a worksheet can really spruce up your charts and make them read even better. Although you may often look at Excel graphic objects as chart enhancements, you can also use them to enhance regular worksheet data. Depending on the type of worksheet model, you may even end up using graphic elements not just to embellish the data, but also to present the data.

Excel supports two types of graphic objects: those that you create yourself and those created by others that you import into the worksheet. This chapter covers how to create graphics with text and text as graphics, as well as basic graphic shapes. It also covers how to import two different types of graphic images: Online graphic images downloaded from the Internet along with local pictures and digital photos stored in a variety of different graphics file formats that Excel can read.

Going Graphical: The Basics of Working with Graphic Objects

It's important to understand that all graphic objects (including embedded charts as covered in Book 5, Chapter 1), whether you create them or import them, are discrete objects in the worksheet that you can select and manipulate. To select a graphic object, you click it. Excel lets you know that the object is selected by placing white circular sizing handles around the perimeter. In the case of 2-D images, the program also adds a circular 2-D rotation handle that appears directly above and connected to the sizing handle of the graphic's perimeter (the handle is on the top edge, in the middle) if the graphic can be rotated. In the case of 3-D models, Excel also adds a central rotation handle that enables you to manipulate the object in the space around its x-, y-, and z- axes. On some drawn objects (especially 3-D ones), yellow shaping handles also appear at the places where you can manipulate some part of the object's shape, as shown in Figure 2-1.

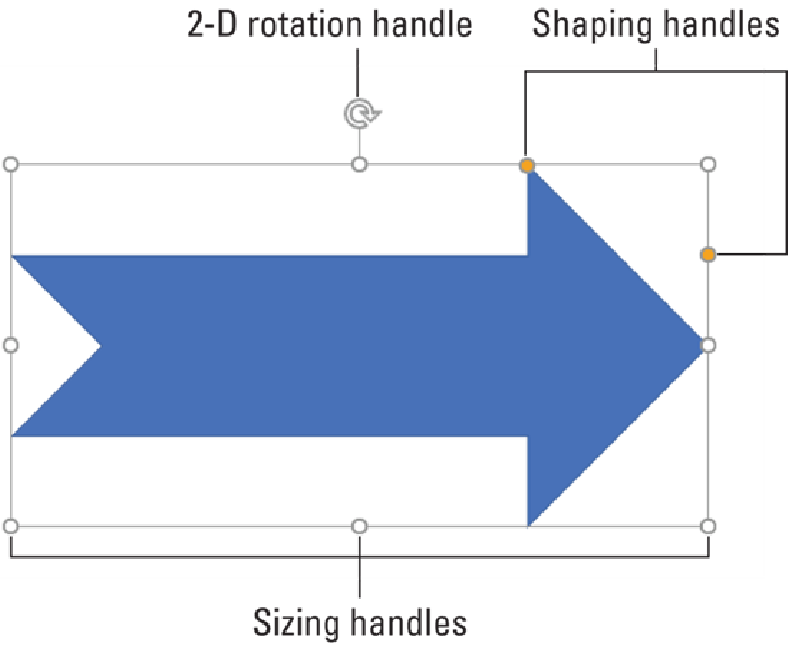


FIGURE 2-1: When you click a graphic object to select it, the rotation and circular sizing handles appear.

To select multiple graphic objects in the worksheet, hold down the Shift or Ctrl key as you click each object. When you select more than one object, any manipulations that you perform affect all the selected objects.

To deselect a graphic object, click the thick, white cross pointer in any cell in the worksheet that it doesn't cover. To deselect an object when you have several graphics selected at one time, click an unobstructed cell or another graphic.

Manipulating graphics

When you position the mouse pointer on a graphic object's sizing handle, the mouse pointer becomes a double-headed arrow that you can then drag to increase or decrease the overall size and shape of the object. To constrain a graphic while resizing it, click the sizing handle and then press and hold down the Shift key as you drag. Holding down the Shift key restricts your dragging so that the graphic retains its original proportions as you make it bigger or smaller. To constrain the proportions of an object in two dimensions, hold down the Shift key as you drag one of the corner sizing handles.

When you position the pointer on a graphic object's 2-D or 3-D rotation handle, the pointer becomes a curved arrow pointing clockwise. As you prepare to drag a 2-D rotation handle, the pointer becomes four curved arrows in a circle pointing in the clockwise direction. You can then rotate the graphic to any degree in a circle that pivots around the rotation handle.

When you position the pointer on an object's 3-D rotation handle, the pointer becomes a circular arrow that's also pointing clockwise. You can then rotate the object in a 3-dimensional space as the handle pivots around the image so that the object can be displayed from any angle above or below as well as in front, on either side, or in back.

When you position the pointer on a graphic's shaping handle (if it has one), the pointer becomes an arrowhead without any handles. You can then drag this pointer to reshape the side or section of the graphic. In the case of some 3-D graphic shapes, dragging the shaping handle rotates a part of the graphic in such a way that it alters the object's perspective, thus changing the way it's viewed.

To move the selected graphic object, position the mouse pointer somewhere on the object's perimeter. Then, when the pointer becomes an arrowhead with a black double-cross at its point, drag the object to its new position within the worksheet. To copy the selected object, hold down the Ctrl key as you drag the graphic. (When you press the Ctrl key, a plus sign, indicating that the object is being copied, appears above the arrowhead pointer.)

REMEMBER When working with graphic objects on a touchscreen, you can use your finger or stylus on the various handles to rotate, reshape, and resize your image. In addition, you can pinch and open your fingers (forefinger and thumb) to resize a selected graphic object, making it smaller and larger, respectively.

TIP When moving graphics in a worksheet, you can make use of an invisible grid to help you position them. This is especially helpful when you're trying to align one graphic with another (for example, when aligning two charts side by side in a worksheet). To turn on the grid, select the graphic object, and then choose the Snap to Grid option in the Arrange group of the object's contextual tab, the name of which depends on the type of graphic:

- **Shape Format:** When the selected graphic object is a drawn graphic, such as a predefined shape, text box, or WordArt.
- **Graphics Format:** When the selected object is an icon downloaded from the extensive online Icon library.
- **Picture Format:** When the selected graphic object is an imported line art image or digital photo, or a screenshot created with the Take a Screenshot command.
- **Format:** When the graphic object is a piece of SmartArt.

After the Snap to Grid feature is turned on, whenever you position an object very close to an invisible horizontal or vertical gridline, it snaps to this line as soon as you release the mouse button.

TIP You can “nudge” a selected graphic object into its desired position with a keyboard by pressing the arrow keys. When you press an arrow key, Excel moves the object just a very little bit in that direction. Nudging is useful when you have an object that’s almost in place and requires very little handling to get it into just the right position.

If you no longer need a graphic object, you can get rid of it by clicking it to select the object and then pressing the Delete key to remove it.

Moving graphic objects to new layers

All graphic objects that you add to a worksheet reside on different invisible layers that sit on top of the worksheet and over the worksheet data in the cells below. This means that if you move a graphic object over a cell that contains an entry, the graphic hides the data beneath it. Likewise, if you draw a shape or add an image and then position it on top of another graphic object (such as an embedded chart or other shape or picture), it also covers up the graphic below.

Figure 2-2 (sample workbook: Graphic Layers.xlsx) illustrates this situation. In this figure, you see a thumbs-up icon (named Graphic 20 in the Selection task pane) partially covering a photo of a hundred-dollar bill (Picture 16) and its caption (TextBox 17) and a 3-D model of a Microsoft Surface Pro (3D Model 18). The distinct layers of the four graphic images are illustrated by their order in the list in the Selection task pane, and the currently selected layer is shown by the green highlight.

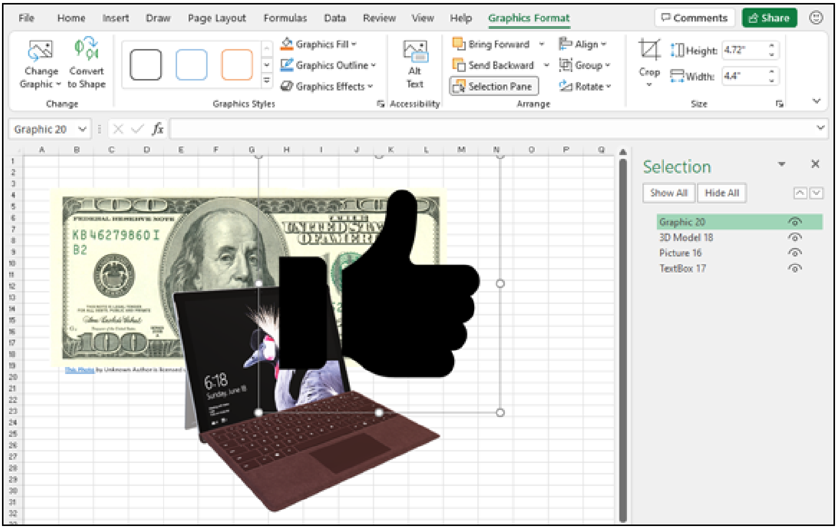

File
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Help
Graphics Format
Comments
Share
Change Graphic
Convert to Shape
Change
Graphics Fill
Graphics Outline
Graphics Effects
Graphics Styles
Alt Text
Accessibility
Bring Forward
Send Backward
Selection Pane
Align
Group
Rotate
Arrange
Crop
Height: 4.72"
Width: 4.4"
Size
Graphic 20
Selection
Show All
Hide All
Graphic 20
3D Model 18
Picture 16
TextBox 17

FIGURE 2-2: Graphic objects on top obscure any worksheet data and parts of other graphics below. (Sample workbook: Graphic Layers.xlsx)

REMEMBER You display the Selection task pane by clicking the Selection Pane command button in the Arrange group of the Format, Graphics Format, Shape Format, or Picture Format contextual tab, depending on the type of graphic object selected.

You can move the graphic objects to other layers on the same worksheet using the Selection task pane. Click the name of the object in this task pane that you want to move and then drag the object up or down to the layer you prefer. Alternatively, click the Bring Forward button (the one with the arrow pointing upward at the top of the task pane to the immediate right of the Hide All button) or the Send Backward button (the one with the arrow pointing downward right next to it) to move the object. Clicking the Bring Forward button moves the selected object up a level in the Selection task pane just as clicking the Send Backward button moves the object down a level.

REMEMBER Any graphic object that appears above others in the list in the Selection task pane obscures all the objects below it, provided that the objects' check boxes in the task pane are not empty but contain eye icons (meaning that they're visible in the worksheet) *and* that the objects overlap each other in whole or in part in their placement on the worksheet.

TIP If the Selection task pane isn't open, you can use the Bring to Front and Send to Back buttons in the Arrange group of the Format, Graphics Format, Shape Format, or Picture Format contextual tab to move them to new layers:

- Choose the **Bring to Front** option from the Bring Forward drop-down menu to bring the selected graphic object to the top of the stack.
- Choose the **Send to Back** option from the Send Backward drop-down menu to send the object to the bottom of the stack.
- Click the **Bring Forward** button to bring the selected object up to the next higher layer.
- Click the **Send Backward** button to send the selected object down to the next layer.

Figure 2-3 (sample workbook: Graphic Layers.xlsx) illustrates how easy it is to move a graphic object to a different level in the Selection task pane. For this figure, I clicked Picture 16 (the hundred-dollar bill) in the list and then selected the Bring to Front option to put this shape on top of all the others.

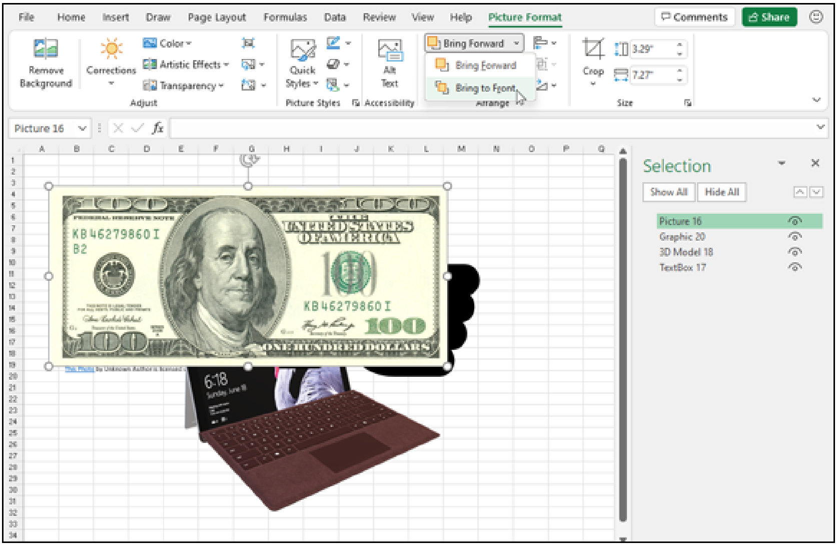

File
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Help
Picture Format
Comments
Share
Remove Background
Corrections
Color
Artistic Effects
Transparency
Adjust
Quick Styles
Picture Styles
Alt Text
Accessibility
Bring Forward
Bring Forward
Bring to Front
Arrange
Crop
3.29"
7.27"
Size
Picture 16
Selection
Show All
Hide All
Picture 16
Graphic 20
3D Model 18
TextBox 17

FIGURE 2-3: The worksheet after moving the hundred-dollar bill graphic to the top layer with the Bring to Front option. (Sample workbook: Graphic Layers.xlsx)

Aligning graphic objects

When you're dealing with multiple graphic objects and you want to align them with each other, begin by selecting the objects in the worksheet. Now you can use the options on the Align button's drop-down menu in the Arrange group of the Format, Graphics Format, Shape Format, or Picture Format contextual tab:

- **Align Left:** Aligns the left edges of the selected graphics with the left edge of the leftmost graphic object.
- **Align Center:** Aligns the center of the selected graphics with the center defined by the halfway point between the left edge of the leftmost graphic object and the right edge of the rightmost graphic object.
- **Align Right:** Aligns the right edges of the selected graphics with the right edge of the rightmost graphic object.
- **Align Top:** Aligns the top edges of the selected graphics with the top edge of the topmost graphic object.
- **Align Middle:** Aligns the vertical middle of the selected graphics with the vertical middle defined by the halfway point between the top edge of the topmost graphic object and the bottom edge of the bottommost graphic object.

- **Align Bottom:** Aligns the bottom edges of the selected graphics with the bottom edge of the bottommost graphic object.
- **Distribute Horizontally:** Equally distributes the selected graphic objects (three or more) horizontally.
- **Distribute Vertically:** Equally distributes the selected graphic objects (three or more) vertically.

Grouping graphic objects

Sometimes you need to work with more than one graphic object. For example, the hundred-dollar bill photo (Picture 16) and its caption (TextBox 17) shown in Figure 2-3 would naturally always be grouped together. If you find that you're constantly selecting two or more objects at the same time to move them or rotate them together, you can make life a lot simpler by grouping the graphics. When you group selected graphic objects, Excel then makes them into a single graphic object, which you can then manipulate.

To group a bunch of graphics together, select them all (either by Shift + clicking or Ctrl + clicking each one). After they're selected, right-click the object on the top layer and then choose Group⇒ Group from the object's shortcut menu or click the Group option from the Group Objects command button's drop-down menu on the Format tab of the object's particular Format contextual tab.

Excel indicates that the selected graphics are now grouped in the worksheet (and for all intents and purposes, are a single graphic object) by placing a single set of sizing handles around the perimeter formed by all the former separate graphics and by giving them a group number in the Selection task pane, as shown in Figure 2-4 (sample workbook: Graphic Layers.xlsx).

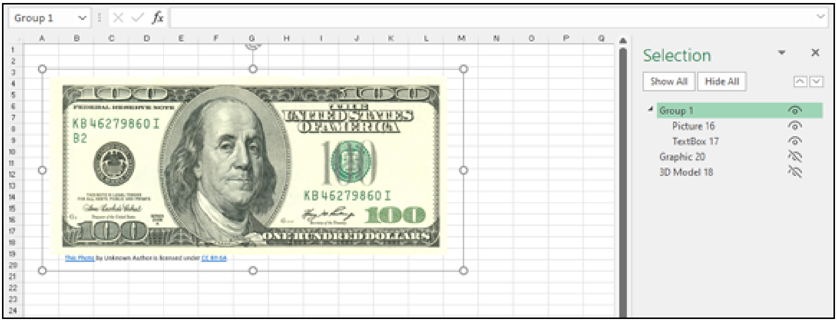


FIGURE 2-4: Grouping the hundred-dollar bill photo and its caption to turn them into a single graphic object. (Sample workbook: Graphic Layers.xlsx)

You can then manipulate the grouped graphic as a single entity by moving it, sizing it, rotating it, and so forth, as you would any other object. In the Selection task pane, Excel creates a new number Group that encompasses the erstwhile separate graphic objects, which are now indented in the list beneath the Group heading.

The great thing about grouping a bunch of different objects is that Excel never forgets that they were once separate objects that you could independently manipulate. This means that you can always turn them back into separate graphics by ungrouping them. To do this, right-click the composite graphic object and then choose Group⇒ Ungroup from its shortcut menu or choose the Ungroup option from the Group Objects command button's drop-down menu on the object's particular Format contextual tab.

Excel shows that the composite object is once again separated into many different objects by displaying sizing handles around each object's perimeter. You can then deselect them all and manipulate each one once again independently by selecting it alone before moving, resizing, or rotating it. If you decide that you want the now-independent objects to be joined as a group once again, you can do this by right-clicking any one of the graphics in the erstwhile group and then choosing Group⇒ Regroup from its shortcut menu or choosing the Regroup option from the Group Objects command button's drop-down menu's Format contextual tab.

Figure 2-4 illustrates grouping in action. For this figure, I selected both the hundred dollar bill photo (Picture 16) and its caption (TextBox 17) and then chose Group from the Group Objects button's drop-down menu. As you can see, in grouping the two objects together into one, Excel created a new Group 1 object in the Selection task pane that consists of Textbox 17 caption and the Picture 16 photo. After grouping the two graphics, not only does the caption move whenever I reposition the hundred-dollar bill, but they also both resize when I modify any of the sizing handles, and they rotate together if I were to manipulate the grouped graphics' rotation handle.

Managing graphic objects in the Selection task pane

As I previously discussed in the "Moving graphic objects to new layers" section earlier in this chapter, the Selection task pane that you display by clicking the Selection Pane button in the Arrange group of the Format, Graphics Format, Shape Format, or Picture Format contextual tab enables you to move graphic objects that overlap one another in some manner to different layers in the stack.

Besides rearranging graphic objects on different layers, you can also use the Selection task pane to select graphic objects for editing or formatting as well as to temporarily hide their display in the worksheet:

- To select a graphic object in the worksheet, click its name in the list in the Selection task pane. To select multiple graphics, press Ctrl as you select their names in the list.
- To hide a particular graphic object in the worksheet, click the eye icon after its name (to close the eye), and to redisplay it, click this eye icon a second time to reopen its eye.
- To hide all the graphic objects (including embedded charts) on the worksheet, click the Hide All button at the top of the task pane, and to redisplay them, click the Show All button.

TIP

Click the graphic object's name in the Selection task pane to select it for editing or formatting whenever the object is difficult to select directly in the worksheet by clicking its shape or image, which is often the case when the object's part of a stack of graphics. If you want to rename the graphic from the generic name Excel gives it (Picture 10, TextBox 12, Right Arrow 11, Group 21, and so forth), click the name in the Selection task pane and then edit or replace it in the text box that then appears. When you finish editing the graphic's name, click outside the text box to apply the new name.

Inserting Different Types of Graphics

Excel enables you to insert many different types of graphic images into your worksheets using the options in the Insert tab's Illustrations group:

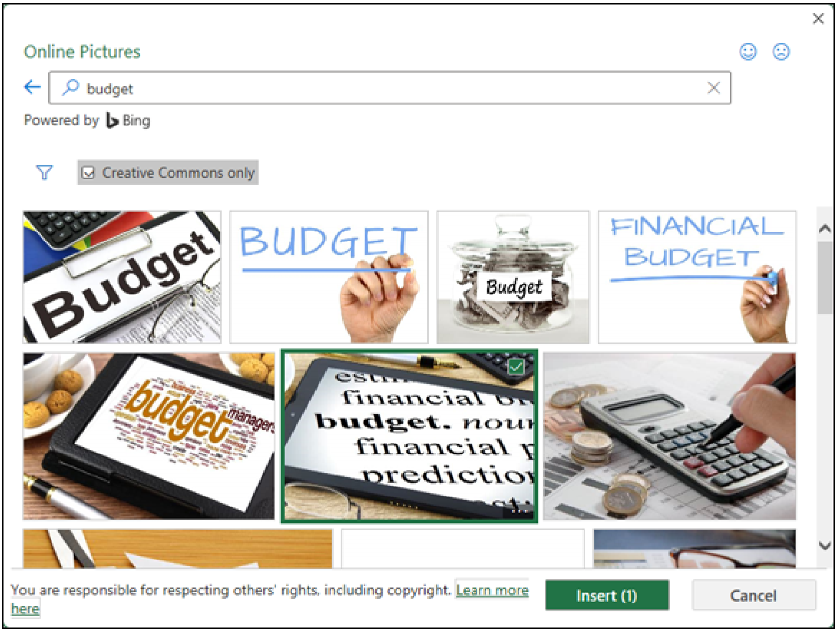
- **Pictures** to import photos and other types of digital artwork saved locally on your computer, often in the Pictures library
- **Online Pictures** to download and insert photos and other types of graphic images saved online — these online images include clip art saved on the Office.com website, web images that you locate using

the Bing search engine, or images that you've saved in the cloud on your OneDrive

- **Shapes** to draw predefined and free-form graphic shapes using any of the shape thumbnails displayed on the drop-down gallery attached to the Shapes option
- **Icons** to download predefined black-and-white icons in a whole host of categories from the Insert Icons gallery
- **3D Models** to download 3-D graphics in several categories from the Microsoft Remix 3D online community website
- **SmartArt** to generate complex graphical lists and relationship charts (like organizational charts) using the gallery opened by selecting the SmartArt option
- **Screenshot** to take a snapshot of all or part of your Windows desktop and insert it as a graphic object in your worksheet

Inserting 2-D online images

Excel enables you to download pictures from the web using the Bing Image search engine and insert them into your worksheets. To download an image, display the Insert tab; then, in the Illustrations group, choose Pictures⇒ Online Pictures to open the Online Pictures dialog box (or press Alt+NPO). Select one of the predefined categories displayed or use the text box to type a keyword for the type of image you want to locate. When conducting a search, after you press Enter or click the Search button (with the magnifying glass icon), the Online Pictures dialog box displays a scrollable list of thumbnails for images matching your keyword. (See Figure 2-5.) You can then position the mouse pointer over any of the thumbnails and click the More Information and Actions button (the three dots in the lower-right corner) to display a short description plus the size (in pixels) of the image in the lower-left corner of the Insert Pictures dialog box.



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You are responsible for respecting others' rights, including copyright. Learn more here

FIGURE 2-5: Selecting a web image to download into your worksheet.

Above the display of thumbnail images, the Online Pictures dialog box also displays the Creative Commons Only check box. This check box is selected by default, which tells you that the online images that Bing has returned in the search use what's called Creative Commons. This licensing grants free distribution of what is otherwise copyrighted material under certain conditions (often noncommercial or educational use). The disclaimer then goes on to urge you to review the license for any image you insert into your worksheet so that you may be certain that you are in compliance with these conditions (always a good idea). If you want, you can deselect the Creative Commons Only check box to also see images that don't use this licensing.

To the left of the Creative Commons Only check box you see the Filter icon. Clicking Filter displays a menu of options that enable you to filter the search results by size (such as Small or Extra Large), image type (such as Photograph or Clipart), image layout (such as Square or Wide), and Color (such as Color Only or Black & White).

To select an image for downloading, click its displayed thumbnail. To select more than one image, click each thumbnail. To insert the selected web image(s) into the current worksheet, click the Insert button.

Inserting 3-D online images

Excel also supports the use of 3-D images downloaded from the Microsoft Remix 3D online community. Display the Insert tab; then, in the Illustrations group, choose 3D Models⇒ Stock 3D Models to open the Online 3D Models dialog box (or press Alt+NS3S), as shown in Figure 2-6. Select a thumbnail of the model from one of its displayed categories or from a search you perform of the 3-D images uploaded to the Microsoft Remix 3D website. When you insert one of these 3-D images into your worksheet, you can rotate it so that it can be viewed from any angle you want.

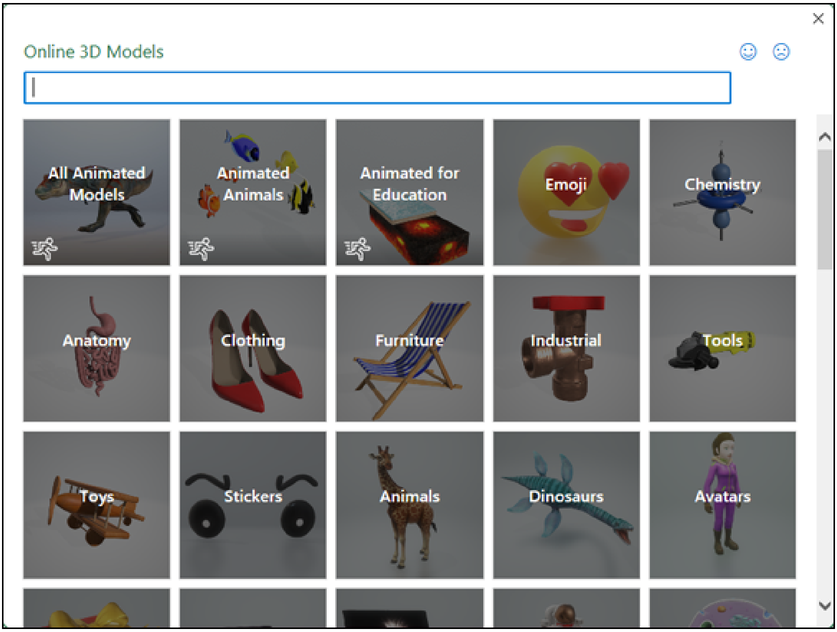

Online 3D Models
All Animated Models
Animated Animals
Animated for Education
Emoji
Chemistry
Anatomy
Clothing
Furniture
Industrial
Tools
Toys
Stickers
Animals
Dinosaurs
Avatars

FIGURE 2-6: Selecting an online 3-D model to insert into your worksheet.

Inserting local pictures

You can insert an image such as a digital photo or a scanned image saved locally on your computer in one of its local or network drives. Display the Insert tab; then, in the Illustrations group, choose Picture⇒ This Device to open the Insert Picture dialog box (or just press Alt +NPD). Just be aware that even though Excel does compress pictures by default, depending upon the size of the photo or digital image, inserting such a graphic can dramatically increase the size of your Excel workbook file.

In the Insert Picture dialog box (see Figure 2-7), select the drive and folder containing the graphics file in the Navigation pane on the left. Next, select the file to insert by clicking the thumbnail of graphics image before clicking the Insert button to open it and insert its image into your open worksheet.

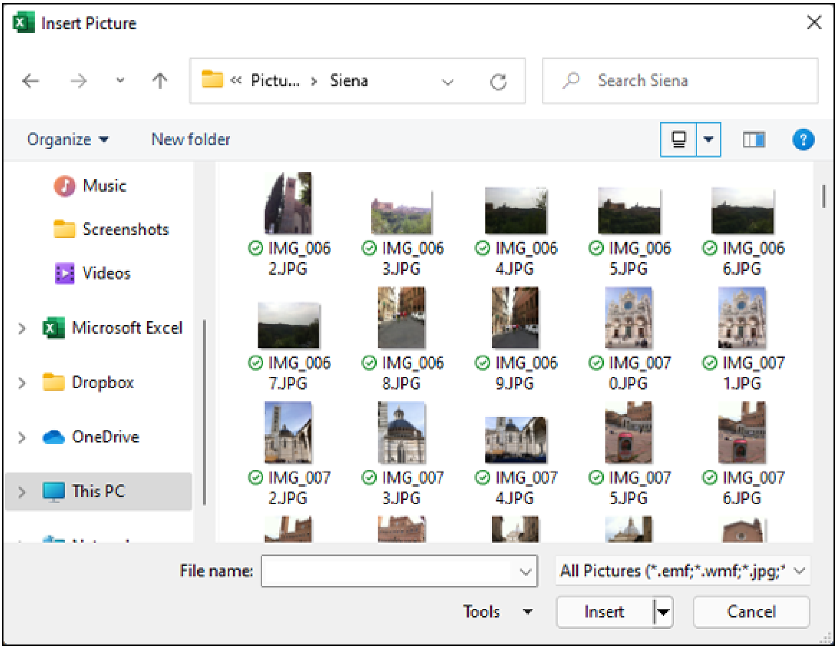

Insert Picture
« Pictu... › Siena
Search Siena
Organize ▾
New folder
Music
Screenshots
Videos
Microsoft Excel
Dropbox
OneDrive
This PC
IMG_0062.JPG
IMG_0063.JPG
IMG_0064.JPG
IMG_0065.JPG
IMG_0066.JPG
IMG_0067.JPG
IMG_0068.JPG
IMG_0069.JPG
IMG_0070.JPG
IMG_0071.JPG
IMG_0072.JPG
IMG_0073.JPG
IMG_0074.JPG
IMG_0075.JPG
IMG_0076.JPG
File name:
All Pictures (*.emf;*.wmf;*.jpg;*
Tools ▾
Insert
Cancel

FIGURE 2-7: Selecting a local image to insert into your worksheet.

TIP

If you want to bring in a graphic image created in another graphics program that's not saved in its own file, you select the graphic in that program and then copy it to the Clipboard. (Choose Home⇒ Copy or press Ctrl + C.) When you get back to your worksheet, place the cursor where you want the picture to go and then paste the image in place. (Choose Home⇒ Paste or press Ctrl + V.)

REMEMBER When you insert a picture from a graphics file into the worksheet, it’s automatically selected (indicated by the sizing handles around its perimeter and its rotation handle at the top). To deselect the graphic image and set it in the worksheet, click anywhere in the worksheet outside of the image.

Inserting icons, stock images, and other ready-made graphics

Excel gives you access to a huge library of ready-to-roll images that you can insert into your worksheets free of charge. To take a peek at what's available, display the Insert tab, and then in the Illustrations group, choose Picture⇒ Stock Images to open the search box shown in Figure 2-8 (or press Alt+NPS). (You can also get to this box by clicking the Icons button or pressing Alt+NNS.) Figure 2-8 shows the Images tab displayed, but you can also select a different tab: Icons, Cutout People, Stickers, and Illustrations. In each case, you see several categories and a few images from the default category. There's also a Search text box that you can use to locate the type of image you want. Click the image or images you want to insert in your worksheet and then click Insert.

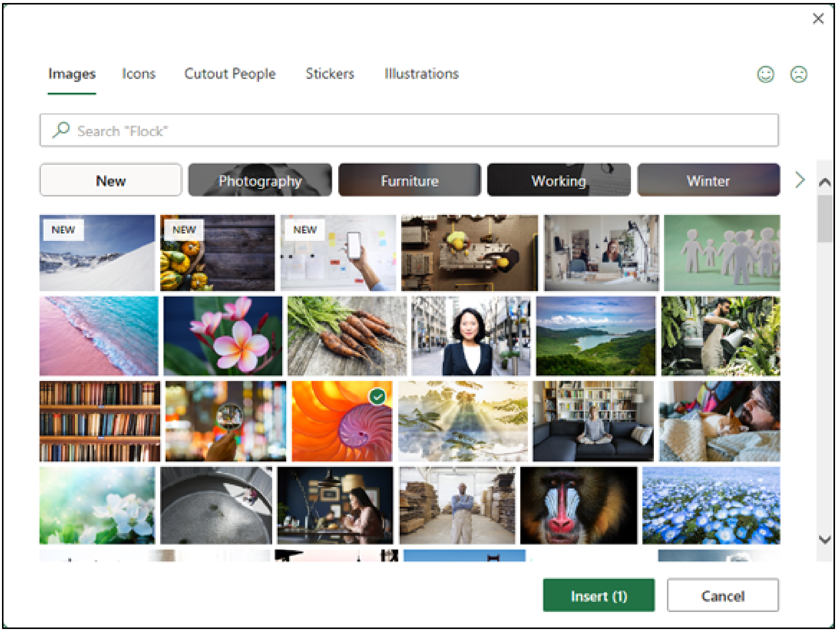

Images
Icons
Cutout People
Stickers
Illustrations
Search "Flock"
New
Photography
Furniture
Working
Winter
NEW
NEW
NEW
Insert (1)
Cancel

FIGURE 2-8: Use this box to select from a large collection of ready-to-use images.

Making Changes to Graphics

After you've inserted a graphic or three, it's unlikely your objects are exactly the way you want them. They may be in the wrong place, they may be the wrong size, or you may want to fix the colors or add some special effects. Fortunately, your worksheet graphics aren't set in stone, so you're free to make as many changes as you need, as the next few sections show.

Editing pictures

As long as a photo or other graphics image is selected in your worksheet (indicated by the sizing handles around its perimeter and a rotation handle at the top), you can make any of the following editing changes to it:

- Move the selected image to a new location in the chart by dragging it.
- Resize the selected image by dragging the appropriate sizing handle.
- Rotate the selected 2-D or 3-D image by dragging its rotation

handle (the green circle at the top) in a clockwise or counterclockwise direction. Rotate a 3-D model in space by dragging its 3-D rotation handle at the center of the image around the graphic

- Delete the selected image by pressing the Delete key.

Formatting photos and line art pictures

When you select a two-dimensional graphics image, Excel adds the Picture Format contextual tab to the Ribbon. The Picture Format tab's command buttons are arranged into several groups: Adjust, Picture Styles, Accessibility, Arrange, and Size. The Adjust group contains the following important command buttons:

- **Remove Background:** Removes the background from the selected image.
- **Corrections:** Increases or decreases the picture's sharpness or brightness and contrast when you click a new preset thumbnail image. Alternatively, click Picture Corrections Options to open the Format Picture task pane, where you can adjust these settings with its Sharpen and Soften or Brightness and Contrast sliders.
- **Color:** Opens a drop-down menu, where you can select a new color thumbnail for the image or select a transparent color that drops out of the picture.
- **Artistic Effects:** Applies a special effect filter to the image when you click one of the preset thumbnail images. You can also click Artistic Effects Options to open the Artistic Effects tab of the Format Picture task pane, where you can select another filter to apply or reset the image by removing all previously applied filters.
- **Transparency:** Sets the transparency of the image when you click one of the preset thumbnail images. You can also click Picture Transparency Options to open the Picture Transparency tools of the Format Picture task pane, where you can choose a preset or set the transparency percentage manually.
- **Compress Pictures:** Opens the Compress Pictures dialog box, where you can compress all images in the worksheet or just the selected graphic image to make them more compact and thus make the Excel workbook somewhat smaller when you save the images as part of its file.
- **Change Picture:** Opens the Insert Picture dialog box, where you can select an image in a new graphics file to replace the picture.

When replacing the currently selected picture with the new image, Excel automatically sizes and formats the new image with the settings applied to the old.

- **Reset Picture:** Removes all formatting changes made and returns the picture to the state it was in when you originally inserted it into the worksheet.

REMEMBER You can also format a picture by opening the Format Picture task pane by selecting the image and then pressing Ctrl+1. Then, click the appropriate button — Fill & Line, Effects, Size & Properties, or Picture — to access the appropriate formatting options.

You can also use the command buttons in the Picture Styles group to format the selected graphic image. Click a thumbnail on the Picture Styles drop-down gallery to select a new orientation and style for the selected picture or select a new border shape on the Picture Shape button's drop-down palette, a new border color on the Picture Border button's drop-down color palette, or a new shadow or 3-D rotation effect from the Picture Effects button's drop-down menu.

REMEMBER You can remove a uniform background in a selected picture by clicking the Remove Background button in the Format tab's Adjust group. Excel then adds a Background Removal contextual tab to the Ribbon and applies a violet filter to the identified background of the selected picture. You can then adjust the violet filter to indicate the extent of the image background to be removed. Then, click the Keep Changes button on the Background Removal contextual tab to close it and to remove the image's background.

Formatting 3-D model images

When you select a 3-D image that you've inserted into your worksheet, Excel adds a 3D Model contextual tab to the Ribbon. The 3D Model tab is divided into the following groups:

- **Play 3D:** For an animated 3D model, enables you to click Play and

Pause to control the animation playback. You can also use the Scenes list to select which scene you want to play.

- **Adjust:** Replaces the selected image with another online or local 3-D model or resets the image to its original rotation and/or size.
- **3D Model Views:** Selects a preset three-dimensional rotation.
- **Accessibility:** Opens the Alt Text task pane where you can enter a description of the graphic that a screen reader can read aloud to a visually-impaired user.
- **Arrange:** Modifies the selected image's layer or groups or aligns it with other images (see "Aligning graphic objects" earlier in this chapter for details).
- **Size:** Enters a new width or height (in inches, if that is the default unit in Excel) for the selected image.

TIP

You can also format a selected 3-D image with the options in the Format 3D Model task pane opened by pressing Ctrl+1 or clicking the Format 3D Model button on the right side of the 3D Model Views group or the Size and Position button on the right side of the Size group on the Format tab under the 3D Model Tools contextual tab. This task pane contains four buttons, Fill & Line, Effects, Size & Properties, and 3D Model, with all sorts of options for formatting the appearance of the selected 3-D image.

Drawing Graphics

On the Insert tab, the Illustration group's Shapes gallery and SmartArt button, along with the Text group's Text Box and WordArt buttons, enable you to draw a wide variety of graphic objects. Some of these graphic objects, including the callout graphics on the Shapes gallery and all the SmartArt, Text Box, and WordArt graphics, enable you to combine text and graphics.

Drawing predefined shapes

On the Insert tab, the Illustration group's Shapes gallery (Alt+NSH) contains a satisfying variety of predefined shapes that you can draw on your worksheet by dragging the mouse pointer.

The Shapes gallery is divided into nine sections: Recently Used Shapes, Lines, Rectangles, Basic Shapes, Block Arrows, Equation Shapes, Flowchart, Stars and Banners, and Callouts.

Click the icon of the shape you want to draw. The pointer becomes a crosshair, which you position where you want the shape to start, and then drag until the shape is the size you want.

REMEMBER After you release the mouse button or remove your finger or stylus from the touchscreen, the shape you've drawn remains selected, as indicated by the sizing and shaping handles around its perimeter and the rotation handle at the top. You can use these handles to resize, reshape, or rotate the graphic as needed. Excel also adds the Shape Format contextual tab to the Ribbon, and you can use this tab's Shape Styles gallery and other buttons to further format the shape until it's exactly the way you want it. To set the shape and remove the handles, click anywhere in the worksheet outside of the shape.

TIP When drawing a rectangle or an oval, you can constrain the tool to draw a square or circle by holding down the Shift key as you drag the mouse. Note that when drawing a two-dimensional shape, such as a rectangle, square, oval, or circle, Excel automatically draws the shape with a blue fill that obscures any data or graphic objects that are beneath the shape on layers below.

REMEMBER Besides drawing basic shapes, lines, and arrows, you can also draw block arrows, equation symbols, flowchart symbols, banners, and callouts by selecting them from their respective areas on the Shapes gallery. Note that after you draw one of the callouts, Excel positions the insertion point within the shape so that you can enter the callout text. After you finish typing the text, click outside the shape to deselect the callout. (See the "Adding text boxes" section that follows for information on how to edit and format the callout text.)

Adding text boxes

Text boxes are special graphic objects that combine text with a rectangular graphic object. They're great for calling attention to significant trends or special features in the charts that you create. (See Book 5, Chapter 1, for details.)

To create a text box, display the Insert tab and then click the Text group's Text Box button (or press Alt+NX). The pointer changes to a thin vertical line with a short horizontal line crossing near the bottom. Drag this pointer to draw the outline of the new text box. When you release the mouse button or remove your finger or stylus from the touchscreen, Excel draws the text box and places the insertion point in the upper-left corner of the box.

You can then type the text that you want displayed in the text box. If you reach the end of the text box and still have more text to enter, you need to make the text box bigger (vertically and/or horizontally) to make sure all the text gets displayed. If you want to break a line before it reaches the right edge of the text box, press the Enter key. When you finish entering the text, click anywhere on the screen outside the text box.

REMEMBER Note that text boxes display two different border patterns when you select them: A dotted-line pattern is displayed when you click inside the text box, thus enabling you to format and edit the text, and a solid-line pattern is displayed when you click the border of the text box or start dragging the box to reposition it, thus indicating that you can format and edit the box itself.

Formatting a text box

After you add a text box, you can format its text by changing the font, font size, font style, and alignment of the text (including its orientation); you can also format the text box by changing its background color and line style, object positioning properties, and its text margins.

To change the formatting of the text entered in a text box, first either click the text box in the Selection task pane (displayed by choosing Shape Format⇒ Selection Pane) or click any border of the text box until the solid outline appears around the box. Then click the appropriate commands in the Home tab's Font and Alignment groups. Choose from the following options:

- **Font** or **Font Size** drop-down list buttons and the **Increase Font Size** and **Decrease Font Size** buttons to change the font or font size of the text. Use Live Preview to see how the new font and font size looks in the text box.
- **Bold, Italic,** or **Underline** buttons to add these attributes to the text in the text box.
- **Font Color** drop-down list to apply a new color to the text in the text box.
- **Align Text Left, Center,** or **Align Text Right** buttons to change the horizontal alignment of the text with respect to the left and right edges of the text box.
- **Top Align, Middle Align,** or **Bottom Align** buttons to change the vertical alignment of the text with respect to the top and bottom edges of the text box.
- **Increase Indent** or **Decrease Indent** buttons to indent text within the box's borders or remove previous indenting.
- **Orientation** button to modify the orientation of the text in the text box by selecting the Vertical Text, Rotate Text Up, or the Rotate Text Down option.

REMEMBER To change the formatting of some of the text in a text box, click inside the text box to open the text for editing and then select the text you want to format.

To change the formatting of the text box itself, first click the text box in the Selection task pane (choose Shape Format⇒ Selection Pane) or click any text box border until the solid outline appears around the box. Then, in the Shape Format contextual tab, choose among the following formatting options:

- **Edit Shape** drop-down list (the one with the dots around the graphic object in the Insert Shapes group) to change the text box shape or edit the wrap points.
- **Shape Styles** gallery to select a new outline, fill, and text color all at one time by clicking one of the gallery's thumbnails (after using Live Preview to see how the new color scheme looks).
- **Shape Fill** drop-down list to select a new color, gradient, picture, or texture for the text box fill or to remove any existing fill (by selecting the No Fill option).
- **Shape Outline** drop-down list to select a new color, line weight, or line style for the outline of the text box or to remove its outline (by selecting the No Outline option).
- **Shape Effects** drop-down list to select a new special effect such as a shadow, glow, or other 3-D effect using the options and palettes available from its drop-down menu.
- **WordArt Styles** drop-down palette to apply a new WordArt style for the text in the text box by clicking one of the gallery's thumbnails (after using Live Preview to see how the new WordArt text style looks).
- **Text Fill** drop-down list to select a new fill color, gradient, picture, or texture for the text in the text box or to remove any existing fill color (by selecting the No Fill option).
- **Text Outline** drop-down list to select a new color, line weight, or line style for the text in the text box or to remove its current outline (by selecting the No Outline option).
- **Text Effects** drop-down list to select a new special effect such as a shadow, glow, or other 3-D effect for the text in the text box using the options and palettes available from its drop-down menu.

TIP When you first enter the text in a text box, Excel sets scanty internal margins so that there's not a lot of white space between the text characters and the edge of the text box. If you're anything like me, one of the first things that you'll want to do is add decent margins to the text box.

To modify the margins, right-click the text box and then choose Format

Shape to open the Format Shape task pane. Click the Size & Properties tab (third to the right under Shape Options) and then click Text Box. Enter the new margin values (in fractions of an inch) that you want to use in the Left Margin, Right Margin, Top Margin, and Bottom Margin text boxes. Also, select the Resize Shape to Fit Text check box if you want Excel to automatically resize the text box to accommodate any formatting changes you make to its text (such as increasing the font size, adding bold, or selecting a new text alignment).

Editing the text in a text box

You can edit the text in a text box as you would in any cell of the worksheet. To insert new text, click the insertion point at the appropriate place and start typing. To delete text, press the Backspace key to delete characters to the left of the insertion point or the Delete key to delete characters to its right. To delete an entire section of text, select it with the I-beam mouse pointer and then press the Delete key.

To spell check some or all of the text in the text box, select the text by dragging the I-beam mouse or Touch pointer through it and then click the Review tab's Spelling button (or press F7).

To delete a text box from the worksheet, click its border to select the box (indicated by the solid as opposed to dotted outline) and then press the Delete key. Be sure that you don’t click inside the box because this selects only the text (indicated by the dotted outline), in which case, pressing the Delete key doesn’t get rid of anything but characters of text at the cursor’s position.

Adding an arrow to a text box

When creating a text box, you may want to add an arrow to point directly to another graphic object or to the part of the worksheet or chart to which you’re referencing. To add an arrow, follow these steps:

1. **Select the text box by clicking any border until the solid outline appears.**

   Sizing handles appear around the text box, and the Shape Format contextual tab appears on the Ribbon.

2. **Click the Arrow command button in the Insert Shapes drop-down gallery at the very beginning of the Format tab.**

   The Arrow command button is the second from the left in the Lines section of Shapes gallery (with the picture of an arrow). When you click this button, it becomes selected in the gallery palette (indicated by the button's green shading) and the mouse or Touch pointer assumes the crosshair shape.

3. **Drag the crosshair pointer from the place on the text box where the end of the arrow (the one *without* the arrowhead) is to appear to the place where the arrow starts (and the arrowhead will appear) and release the mouse button.**

   As soon as you release the mouse button or remove your finger or stylus from the touchscreen, Excel draws two points, one at the base of the arrow (attached to the text box) and another at the arrowhead. At the same time, the contents of the Shape Styles drop-down gallery changes to line styles.

4. **Click the More button in the lower-right corner of the Shapes Styles drop-down gallery to display the thumbnails of all its line styles and then highlight individual thumbnails to see how the arrow would look in each.**

   As you highlight the different line styles in this gallery, Excel draws the arrow between the two selected points in the text box using the highlighted style.

5. **Click the thumbnail of the line style you want the new arrow to use in the Shape Styles gallery.**

Excel then draws a new arrow using the selected shape style, which remains selected (with sizing handles at the beginning and end of the arrow). You can then edit the arrow as follows:

- Move the arrow by dragging its outline into position.
- Change the length of the arrow by dragging the sizing handle at the arrowhead.
- Change the direction of the arrow by pivoting the mouse or Touch pointer around a stationary selection handle.

- Change the shape of the arrowhead or the thickness of the arrow’s shaft by clicking a thumbnail on the Shape Styles drop-down gallery or clicking a new option on the Shape Fill, Shape Outline, and Shape Effects button on the Format tab of the Drawing Tools contextual tab. Alternatively, open the Format Shape task pane (Ctrl + 1) and then select the appropriate options after selecting the Fill & Line, Effects, Size & Properties, or Picture button.
- Delete the arrow by pressing the Delete key.

Inserting WordArt

Excel's WordArt gallery enables you to add artsy text to the worksheet. The only thing to keep in mind when adding WordArt is that, just as its name implies, this text is really a graphic (art) object that behaves just like any other Excel graphic object although it contains only text.

You add WordArt to your worksheet by following these steps:

1. **In the Insert tab's Text group, click the WordArt drop-down button (or press Alt + NW).**

   Excel displays the WordArt drop-down gallery, as shown in Figure 2-9.

2. **Click the A thumbnail in the WordArt style you want to use in the WordArt drop-down gallery.**

   Excel inserts a selected text box containing `Your Text Here` in the center of the worksheet with this text in the WordArt style you selected in the gallery.

3. **Type the text you want to display in the worksheet in the Text box.**

   As soon as you start typing, Excel replaces the `Your Text Here` text in the selected text box with the characters you enter.

4. **(Optional) To format the background of the text box, use Live Preview in the Shape Styles drop-down gallery on the Format tab to find the style to use and then set it by clicking its thumbnail.**

   The Format tab on the Drawing Tools contextual tab is automatically added and activated whenever WordArt text is selected in the worksheet.

5. **After making any final adjustments to the size, shape, or orientation of the WordArt text with the sizing and rotation handles, click a cell somewhere outside of the text to deselect the graphic.**

   Note that Excel automatically compresses the text to fill the shape and size of its text box. To put more space between the words and the characters in each word, make the text box wider by dragging the sizing handle on either side of the text box.

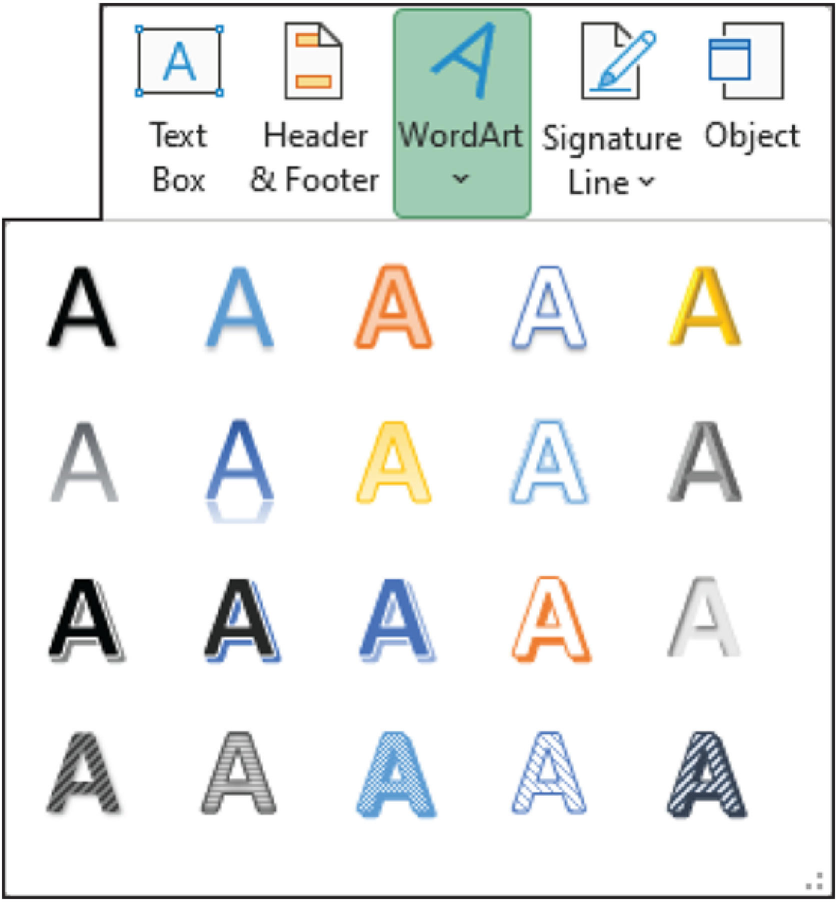


FIGURE 2-9: Selecting the text style for the new WordArt text from its drop-down gallery.

When you click outside of the WordArt text, Excel deselects the graphic, and the Drawing Tools contextual tab disappears from the Ribbon. (If you ever want this tab to reappear, all you have to do is click somewhere on the WordArt text to select the graphic.)

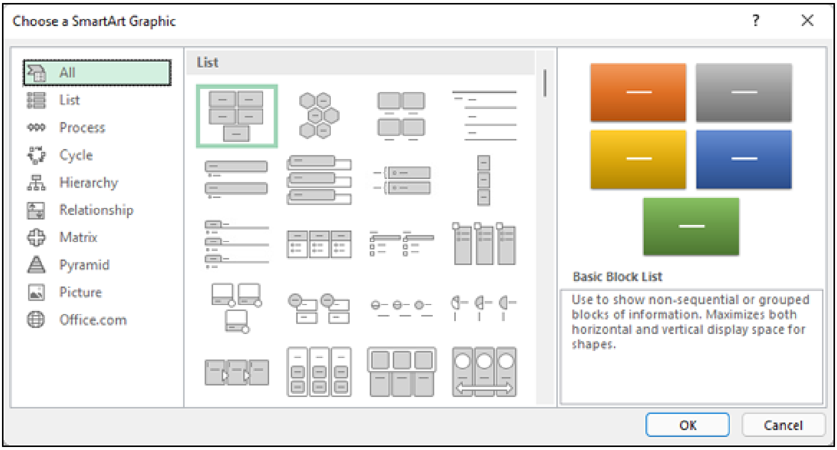
Inserting SmartArt graphics

SmartArt graphics enable you to quickly construct fancy graphical lists, diagrams, and captioned pictures in your worksheet. SmartArt lists, diagrams, and pictures come in a wide array of configurations that include a variety of organizational charts and flow diagrams that enable you to add your own text to predefined graphic shapes.

To insert a SmartArt graphic into the worksheet, click the Insert tab's

SmartArt button in the Illustrations group (or press Alt+M1). Excel opens the Choose a SmartArt Graphic dialog box (shown in Figure 2-10), where you select a category in the navigation pane on the left followed by the list's or diagram's thumbnail in the center section before you click OK.

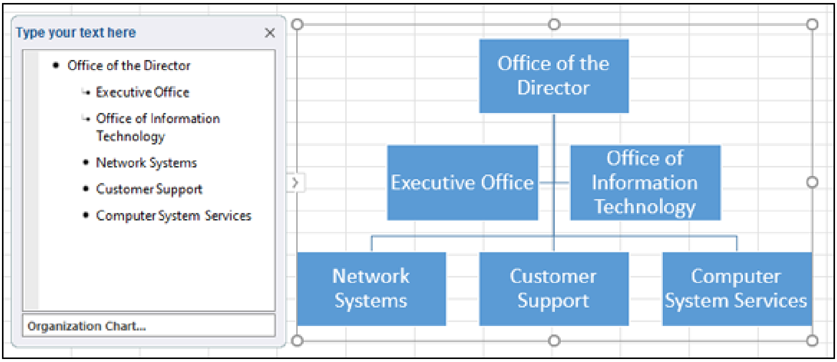
Excel then inserts the basic structure of the list, diagram, or picture into your worksheet with [Text] placeholders showing where you can enter titles, descriptions, or captions (as shown in Figure 2-11), or, in the case of SmartArt pictures, picture icons showing where you can insert your own pictures into the SmartArt graphic. At the same time, the SmartArt Design contextual tab appears on the Ribbon with Layouts and SmartArt Styles galleries for the particular type of SmartArt list or diagram you originally selected.


Choose a SmartArt Graphic
?
×
All
List
Process
Cycle
Hierarchy
Relationship
Matrix
Pyramid
Picture
Office.com
List
OK
Cancel

Basic Block List

Use to show non-sequential or grouped blocks of information. Maximizes both horizontal and vertical display space for shapes.

FIGURE 2-10: Select the SmartArt list, diagram, or picture to insert in the worksheet in this dialog box.


Type your text here
×
Organization Chart...
Office of the Director
Executive Office
Office of Information Technology
Network Systems
Customer Support
Computer System Services

- Office of the Director
  - Executive Office
  - Office of Information Technology
  - Network Systems
  - Customer Support
  - Computer System Services

FIGURE 2-11: Adding text for a new organizational chart in the SmartArt text pane.

Filling in the text for a new SmartArt graphic

To fill in the text for your new SmartArt graphic, click its [Text] placeholder and then type the text.

When you finish entering the text for your new diagram, click outside the graphic to deselect it.

REMEMBER If the style of the SmartArt list or diagram you select comes with more sections than you need, you can delete the unused graphics by clicking them to select them (indicated by the selection and rotation handles around it) and then pressing the Delete key.

Adding images to a SmartArt picture

If the SmartArt graphic object you've added to your worksheet is one of those from the Picture group of the Choose a SmartArt Graphic dialog box, your selected SmartArt graphic contains an Insert Picture button (marked only by a small picture icon) along with the [Text] indicators. To add a graphic image to the SmartArt object, click this picture icon to open an Insert Pictures dialog box with the following four options:

- **From a File:** Opens the Insert Picture dialog box where you can select a local photo or other graphic image saved in a local or networked drive on your computer (see "Inserting local pictures" earlier in this chapter).
- **Stock Images:** Opens the search box shown earlier in Figure 2-8 with the Images tab selected, where you can choose a stock image to use with your SmartArt graphic.
- **Online Pictures:** Opens the Online Pictures dialog box where you can download a photo or other graphic image from an online source such as Flickr or your OneDrive (see "Inserting 2-D online images" earlier in this chapter).
- **From Icons:** Opens the Insert Icons dialog box where you can select one of the many categories of black and white images to insert.

Formatting a SmartArt graphic

After you deselect your SmartArt graphic, you can still format its text and format. To format the text, select all the graphic objects in the SmartArt list or diagram that need the same type of text formatting — remember you can select several objects in the list or diagram by holding down Ctrl as you click them — and then clicking the appropriate command buttons in the Home tab's Font group.

To refine or change the default formatting the SmartArt graphic, you can use the Layouts, Change Colors, and SmartArt Styles drop-down galleries available on the SmartArt Design contextual tab:

- Click the More button in the Layouts group and then click a thumbnail on the Layouts drop-down gallery to select an entirely new layout for your SmartArt graphic.
- Click the Change Colors button in the SmartArt Styles group and then click a thumbnail in the drop-down Theme Colors gallery to change the color scheme for the current layout.
- Click the More button in the SmartArt Styles group and then click a thumbnail on the SmartArt Styles drop-down gallery to select a new style for the current layout, using the selected color scheme.

Adding Screenshots of the Windows Desktop

The Screenshot command button in the Illustrations group of the Insert tab enables you to capture Windows desktop graphics and insert them directly into your worksheet. Before clicking this button, you need to open the other application window whose document you want to capture as an Excel graphic object or set up the Windows desktop icons that you want to capture.

Then, switch back to the Excel program window and click the Insert tab's Screenshot button in the Illustrations group (press Alt+NSC). Excel then opens a Screenshot drop-down menu.

If you have application windows open on the Windows desktop, a thumbnail of each window appears on this Screenshot drop-down menu under the heading Available Screen Shots. To capture one of the open window’s information as a graphic object in the current Excel worksheet, click its thumbnail on this drop-down menu and Excel adds the window as a selected graphic in your sheet.

If you don’t want to capture any of the discrete application windows as graphics, you can use the Screen Clipping option that appears at the bottom of the Screenshot drop-down menu to select the section of the desktop to capture as a graphic. When you click the Screen Clipping option, Windows minimizes the Excel application window and displays the desktop with all of its windows and icons displayed but in a gauzy, hazy transparent mode. You then drag the black-cross pointer to select the section of the desktop you want captured as a worksheet graphic object. (As you drag, Windows removes the gauzy effect from the area you select.) When you release the mouse button, Windows immediately reopens the Excel program window with the section of the desktop added as a selected worksheet graphic.

Using Themes

With themes, Excel enables you to uniformly format all the graphics that you add to a worksheet. You can select a new theme for the active worksheet by clicking the Page Layout tab's Themes drop-down button (or by pressing Alt+PTH) and then clicking the thumbnail of the theme you want to use.

REMEMBER Use Live Preview to see how the graphics you’ve added to your worksheet appear in the new theme before you click its thumbnail.

Excel Themes combines three default elements: the color scheme applied to the graphics, the fonts (body and heading) used in the graphics, and the graphic effects applied. If you prefer, you can change any or all of these three elements in the worksheet by clicking their individual command buttons in the Themes group at the start of the Page Layout tab:

- **Colors** to select a new color scheme by clicking its thumbnail of its color swatches on the drop-down palette. Click Customize Colors at the bottom of this palette to open the Create New Theme Colors dialog box where you can customize each element of the color scheme and save it with a new descriptive name.
- **Fonts** to select a new font by clicking its thumbnail on the drop-down list. Click Customize Fonts at the bottom of this list to open the Create New Theme Fonts dialog box, where you can customize

the heading and body fonts for both Latin and East Asian text and save it with a new descriptive name.

- **Effects** to select a new set of graphics effects by clicking its thumbnail in the drop-down gallery.

TIP

To save your newly selected color scheme, font, and graphic effects as a custom theme that you can reuse in other workbooks, click the Themes command button and then click Save Current Theme at the bottom of the gallery to open the Save Current Theme dialog box. Edit the generic Theme1 name in the File Name text box (without deleting the `.thmx` filename extension) and then click the Save button. Excel then adds the custom theme to a Custom Themes section in the Themes drop-down gallery that you can apply to any active worksheet by clicking its thumbnail.

Book 6

Data Management

Contents at a Glance

Chapter 1: Building and Maintaining Tables

- Table Basics
- Sorting Table Data
- Subtotaling Table Data

Chapter 2: Filtering and Querying a Table

- Filtering Data
- Using the Database Functions
- Querying External Data

Chapter 1

Building and Maintaining Tables

IN THIS CHAPTER

- **Setting up a table**
- **Adding data to a table**
- **Editing records in a table**
- **Finding records in a table**
- **Sorting records on values in a table**
- **Sorting a list on font color, fill color, or cell icons**
- **Subtotaling data in a table**

In addition to its considerable computational capabilities, Excel is also very accomplished at maintaining vast collections of related data in what are referred to as *tables*. This chapter covers all the basic procedures for creating and then maintaining different types of tables in the Excel worksheet.

This basic information includes how to design the basic table and then format it as a table so that you can add new data to the list without having to redefine it and can sort its data so that it's arranged the way you like to see the information. For tables that contain numerical data, you also find out how to subtotal and total the data. For information on how to find data in the table and produce subsets of the list with just the data you need, see Book 6, Chapter 2.

Table Basics

In Excel, a table is a range of worksheet data with a special structure.

Unlike the other types of ranges that you may create in an Excel worksheet, a table uses *only* column headings (technically known as *field names*) to identify the different kinds of items that the table tracks. Each column in the table contains information for each item you track in the database, such as the client's company name or telephone number (technically known as a *field* of the table). Each row in the table contains information about each entity that you track in the table, such as ABC Corporation or National Industries (technically known as a *record* of the table).

After you've organized your data into a table that follows this structure, you can then use a variety of commands on the Ribbon's Data tab to maintain the data, as well as to reorder the information it contains. In tables with numerical fields, you can also use the Subtotal command button to calculate subtotals and totals in the list when a certain field changes.

Designing the basic table

All you have to do to start a new table in a worksheet is to enter the names of the fields that you want to track in the top row of the worksheet, enter the first record of data beneath, and then format the two rows of data as a table. (See Book 2, Chapter 1 for details.) When entering the field names (as column headings), be sure each field name in the table is unique and, whenever possible, keep the field name short. When naming fields, you can align the field name in the selected cell so that its text wraps to a new line by clicking the Home tab's Wrap Text button (or press Alt+HW). Also, you should not use numbers or formulas that return values as field names. (You can, however, use formulas that return text, such as a formula that concatenates labels entered in different cells.)

When deciding on what fields you need to create, you need to think of how you'll be using the data that you store in your table. For example, in a client table, you split the client's name into separate title, first name, and last name fields if you intend to use this information in generating form letters and mailing labels with your word processor. That way, you can address the person by his or her first name (as in *Dear Jane*) in the opening of the form letter you create, as well as by his or her full name and title (as in *Dr. Jane Jackson*) in the mailing label you generate.

Likewise, you split up the client's address into separate street address, city, state, and zip code fields when you intend to use the client table in generating form letters, and you also want to be able to sort the records in descending order by zip code and/or send letters only to clients located in the states of New York, New Jersey, or Connecticut. By keeping discrete pieces of information in separate fields, you're assured that you can use that field in finding particular records and retrieving information from the table, such as finding all the records where the state is California or the zip code is between 94105 and 95101.

To set up a new table in a worksheet, you follow these steps:

1. **Click the blank cell where you want to start the new table and then enter the column headings (field names) that identify the different kinds of items you need to keep track of.**

   After creating the fields of the table by entering their headings, you're ready to enter the first row of data.

2. **Make the first entries in the appropriate columns of the row immediately below the one containing the field names.**

   These entries in the first row beneath the one with the field names constitute the first *record* of the table.

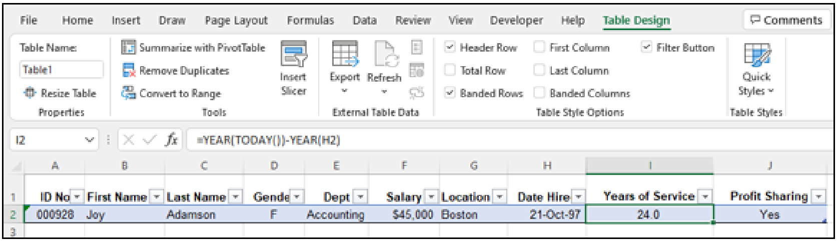
3. **Select at least one of your cell entries, choose Home⇒ Format as Table, and then click a thumbnail of one of the table styles in the gallery.**

   Excel displays a marquee around all the cells in the new table including the top row of field names. When you click a table style in the gallery, the Create Table dialog box appears, listing the address of the cell range enclosed in the marquee in the Where Is the Data for Your Table text box, and the My Table Has Headers check box is selected.

4. **Click OK to close the Create Table dialog box.**

Excel formats your new table in the selected table format and adds AutoFilter (drop-down buttons) to each of the field names in the top row.

Figure 1-1 shows a new employee table after formatting the first row with the field names and second row with the first data record as a table using Table Style Light 1. This new table begins in row 1 of this worksheet, which contains the column headings with the names for the ten fields in this table (ID No through Profit Sharing) all with AutoFilter buttons (thanks to the formatting as a table). Note that employees' names are divided into separate First Name and Last Name fields in this list (columns B and C, respectively). Note too, that the first actual record of the table is entered in row 2 of the worksheet, directly under the row with the field names. When entering your records for a new table, you don't skip rows but keep entering each record one below the other going down successive rows of the worksheet.


File
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Developer
Help
Table Design
Comments
Table Name:
Table1
Resize Table
Properties
Summarize with PivotTable
Remove Duplicates
Convert to Range
Tools
Insert Slicer
Export
Refresh
External Table Data
☑ Header Row
☐ Total Row
☑ Banded Rows
☐ First Column
☐ Last Column
☐ Banded Columns
☑ Filter Button
Table Style Options
Quick Styles
Table Styles
I2
A
B
C
D
E
F
G
H
I
J
1
2
3

=YEAR(TODAY())-YEAR(H2)

ID No	First Name	Last Name	Gende	Dept	Salary	Location	Date Hire	Years of Service	Profit Sharing
000928	Joy	Adamson	F	Accounting	$45,000	Boston	21-Oct-97	24.0	Yes

FIGURE 1-1: Creating an employee table with the row of field names and first data record.

When you're entering the row with the first data record, be sure to format all the cells the way you want the entries in that field to appear in all the subsequent data records in the table. For example, if you have a Salary field in the table, and you want the salaries formatted with the Currency style number format without any decimal places, be sure to format the salary entry in the first record in this manner. If you have a Zip Code field, format it with the Special Zip Code format or as Text so that Excel doesn't drop the initial zeros from codes that begin with them such as 00234. That way, all subsequent records pick up that same formatting for their respective fields when you enter them with Excel's data form.

Converting a range to a table (and back again)

What if you already have a range of data that you want to convert to a table? No problem. First, make sure the top row of your range has the text heading you want to use as your column names. Use any of the following techniques to convert the range to an honest-to-goodness table:

- Select any cell within the range and then choose Insert⇒ Table to open the Create Table dialog box, double-check that the range address in the Where Is the Data For Your Table? text box is correct, select the My Table Has Headers check box, and then click

OK.

- Select the entire range, click the Quick Analysis button (or press Ctrl + Q), click the Tables tab, and then click Table.
- Select any cell within the range, choose Home⇒ Format as Table, and then click a table format to open the Create Table dialog box. Make sure the range address in the Where Is the Data For Your Table? text box is correct, select the My Table Has Headers check box, and then click OK.

Creating calculated fields

When creating a new table, you can make full use of Excel's calculating capabilities by defining fields whose entries are returned by formula rather than entered manually. The sample employee list introduced in Figure 1-1 contains just such a calculated field (shown on the Formula bar) in cell I2 that contains the first entry in the Years of Service field.

The original formula for calculating years of service in cell I2 is as follows:

```
=YEAR(TODAY())-YEAR(H2)
```

This formula uses the YEAR Date function to subtract the serial number of the year in which the employee was hired (entered into the Date Hired field) in cell H2 from the serial number of the current year (returned by the TODAY function). After entering and formatting this original formula in cell I2, the data table picks up this formula and automatically copies it and applies it to any new record you add to the table.

Modifying the structure of the table

You may find after creating your table that you need to modify its structure. Here are the techniques you can use:

- **Renaming the table:** Excel supplies each new table with a default name such as Table1. Boring! To give your new table a more descriptive name, select any cell with the table, select the Table Design contextual tab, and then use the Table Name text box (it's in the Properties group on the far left of the tab) to enter the name you prefer.
- **Resizing the table:** If you accidentally include one or more columns or rows in your table, you can resize the table to exclude those columns or rows. Select any cell in the table and choose Table Design⇒ Resize Table. In the Resize Table dialog box that appears, select the correct range for your table and click OK.

- **Inserting a new field:** If you need to add a new field to the table, you can insert the field as a new column anywhere within the existing table. Select any cell in the field to the left of which you want to add the new field. Choose Home⇒ Insert⇒ Insert Table Columns to the Left.
- **Inserting a new record:** If you need to add a new record to the table, you can insert the record as a new row anywhere within the existing table. Select any cell in the record above which you want to add the new record. Choose Home⇒ Insert⇒ Insert Table Rows Above.
- **Deleting an existing field:** If your table has one or more fields you no longer need, you can delete the fields. Select at least one cell in each field you want to remove and then choose Home⇒ Delete⇒ Delete Table Columns.
- **Deleting an existing record:** If your table has one or more records you want to get rid of, you can delete those records. Select at least one cell in each record you want to delete and then choose Home⇒ Delete⇒ Delete Table Rows.

Add new records to a table

After creating the field names and one record of the table and formatting them as a table, you're ready to start entering the rest of the records in subsequent rows of the list. The most direct way to do this is to press the Tab key when the cell cursor is in the last cell of the last record. Excel tacks on an extra row to the table, where you can enter the appropriate information for the next record.

TIP

When doing data entry directly in a table, press the Tab key to proceed to the next field in the new record rather than the → key. That way, when you complete the entry in the last field of the record, you automatically extend the table, add a new record, and position the cell cursor in the first field of that record — if you press → to complete the entry, Excel moves the cell cursor to the next cell outside of the table.

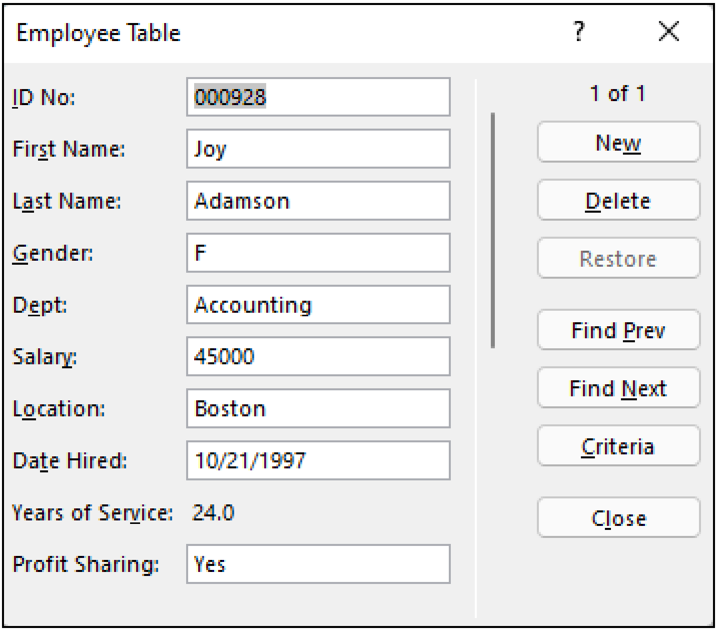
Using the data form

The first time you click the custom Form button you've added to the Quick Access toolbar, Excel analyzes the row of field names and entries for the first record and creates a data form that lists the field names down the left side of the form, with the entries for the first record in the appropriate text boxes next to them.

Figure 1-2 (sample workbook: Employee data.xlsx) shows you the data form that Excel creates for the sample Employee table shown earlier in Figure 1-1. The data form consists of a dialog box (whose title bar contains the name of the current worksheet file, which just happens to be Employee Table) that contains a vertical listing of each field defined for the table.

ADDING THE FORM BUTTON

Instead of entering the records of a table directly in the table, you can use Excel's data form to make the entries. The only problem with using the data form is that its command button is not found anywhere on the Ribbon: The only way to access the data form is by adding its command button in a custom Ribbon tab; see Book 1, Chapter 2, to find out how to add commands and tabs to the Ribbon. Alternatively, you can display the Quick Access toolbar (see Book 1, Chapter 1) and add the Form command to it (as I describe in Book 1, Chapter 2).


Employee Table

ID No: 000928
First Name: Joy
Last Name: Adamson
Gender: F
Dept: Accounting
Salary: 45000
Location: Boston
Date Hired: 10/21/1997
Years of Service: 24.0
Profit Sharing: Yes

FIGURE 1-2: Opening the data form in the new table to add a new record. (Sample workbook: Employee data.xlsx)

When you click the custom Form button on the Quick Access toolbar to display the data form, Excel automatically displays the field entries for the first record entered (which just happens to be the only record in the list at this point). On the right side of the dialog box, the data form indicates the current record number out of the total number of records in the table (1 of 1 in this case). This part of the form also contains a number of command buttons that enable you to add a new record, find a particular record for editing, or delete a record from the table.

When the data form is displayed in the active document, you can use the scroll bar to the right of the fields to move through the records in the table, or you can use various direction keys. Table 1-1 summarizes the use of the scroll bar and these keys. For example, to move to the next record in the table, you can press the ↓ or the Enter key or click the scroll arrow at the bottom of the scroll bar. To move to the previous record in the table (assuming there's more than one), you can press the ↑ key or Shift+Enter key or click the scroll arrow at the top of the scroll bar. To select a field in the current record for editing, you can click that field's text box or press the Tab key (next field) or press Shift+Tab (previous field) until you select the field (and its current entry).

Note that the data form does not allow you to select and edit calculated fields (such as the Years of Service field shown earlier in Figure 1-2). Although calculated fields and their current entries are listed in the data form, the form doesn't bother to provide a text box for the fields for making editing changes. To modify the contents of a calculated field, you would need to modify the original formula in the appropriate field in the first record and recopy the edited formula down to the other existing records in the list.

TABLE 1-1 Techniques for Navigating the Data Form

Movement	*Keystrokes or Scroll Bar Technique*
Next record, same field in the table	Press ↓ or the Enter key, click the downward-pointing scroll arrow, or click the Find Next command button.
Previous record, same field in the table	Press ↑ or Shift+Enter, click the upward-pointing scroll arrow, or click the Find Prev command button.
Next field in the data form	Press Tab.
Previous field in the data form	Press Shift+Tab.
Move 10 records forward in the table	Press PgDn.
Move 10 records backward in the table	Press PgUp.
Move to the first record in the table	Press Ctrl+↑ or Ctrl+PgUp or drag the scroll box to the top of the scroll bar.
Move to the last record in the table	Press Ctrl+↓ or Ctrl+PgDn or drag the scroll box to the bottom of the scroll bar.
Move within a field	Press ← or → to move one character at a time, press Home to move to the first

character, and press End to move to the last character.

Adding new records with the data form

To add a new record to the table, you can either move to the end of the table (by dragging the scroll box to the very bottom of the scroll bar or by pressing Ctrl+↓ or Ctrl+PgDn) or click the New command button. Any way you do it, Excel displays a blank data form (marked New Record at the right side the dialog box), which you can then fill out. After entering the information for a field, press the Tab key to advance to the next field in the record. (Be careful not to press the Enter key because doing so inserts the new record into the table.)

When you're making an entry in a new field, you can copy the entry from the same field in the previous record into the current field by pressing Ctrl+" (double quotation mark). You can use this keystroke shortcut, for example, to carry forward entries in the text box for the State field when you are entering a series of records that all use the same state.

When you've entered all the information you have for the new record, press the ↓ or the Enter key or click the New button again. Excel then inserts the new record as the last record in the table and displays a blank data form where you can enter the next record. When you finish adding records to the table, press the Esc key or click the Close button to close the Data Form dialog box.

Editing records in the data form

The data form makes it easy to edit records in your table. In a smaller table, you can use the navigation keys or the scroll bar in the data form to locate the record that requires editing. In a larger table, you can use the Criteria command button to quickly locate the record you need to change, as described in the next section.

When you've displayed the data form for the record that needs editing, you can then perform your editing changes by selecting the text boxes of the necessary fields and making your changes, just as you would edit the entry in its cell in the worksheet.

Finding records with the data form

You can use the Criteria button in the data form to find the records in your table that you need to edit (or delete as described in the next section). When you click the Criteria button in the data form, Excel clears all the field text boxes so that you can enter the criteria to search for. For example, assume that you need to edit Sherry Caulfield's profit-sharing status. You don't have her paperwork in front of you, so you can't look up her employee number. You do know, however, that she works in the Boston office and, although you don't remember exactly how she spells her last name, you do know that it begins with a C instead of a K.

To locate her record, you can at least narrow the search down to all the records where the Location field contains Boston and the employee's Last Name begins with the letter *C*. To do this, you open the data form for the Employee table, click the Criteria command button, and then enter the following in the Last Name field:

```
C*
```

Then, in the Location field, you enter

```
Boston
```

When entering the criteria for locating matching records in the data form, you can use the question mark (?) and the asterisk (*) wildcard characters, just as you do when using the Excel Find feature to locate cells with particular entries. (See Book 2, Chapter 3, for a review of using these wildcard characters.)

When you click the Find Next button or press the Enter key, Excel locates the first record in the table where the last name begins with the letter *C* and the location is Boston. This is William Cobb's record. Then, to locate the next record that matches your criteria, click the Find Next button or press Enter, which brings you to Sherry Caulfield's record. Having located Sherry's record, you can then change her profit-sharing status by selecting the Profit Sharing text box and replacing No with Yes. Excel inserts the editing change that you make in the record's data form into the table itself as soon as you close the Data Form dialog box by clicking the Close button.

When using the Criteria button in the data form to find records, you can use the following logical operators when entering search criteria in fields that use numbers or dates:

- **Equal to (=):** Finds records with the same text, value, or date you enter.
- **Greater than (>):** Finds records after the text characters (in the alphabet) or the date, or larger than the value you enter.
- **Greater than or equal to (>=):** Finds records the same as the text characters, date, or value you enter or after the characters (in the alphabet), after the date, or larger than the value.

- **Less than (<):** Finds records before the text characters (in the alphabet) or date or smaller than the value you enter.
- **Less than or equal to (< =):** Finds records the same as the text characters, date, or value you enter or before the characters (in the alphabet) or the date, or larger than the value.
- **Not equal to (< >):** Finds records not the same as the text, value, or date you enter.

For example, to find all the records where the employee's annual salary is $50,000, you can enter =**50000** or **50000** in the Salary field text box. However, to find all the records for employees whose annual salaries are less than or equal to $35,000, you enter < =**35000** in the Salary field text box. To find all the records for employees with salaries greater than $45,000, you would enter >**45000** in the Salary field text box instead. If you wanted to find all the records where the employees are female *and* make more than $35,000, you would enter **F** in the Gender field text box and >**35000** in the Salary field text box in the same Criteria data form.

When specifying search criteria that fit a number of records, you may have to click the Find Next or Find Prev button several times to locate the record you want to work with. If no record fits the search criteria you enter in the Criteria data form, your computer beeps at you when you click the Find Next or Find Prev button.

To change your search criteria, select the appropriate text box(es) and delete the old criteria and then enter the new criteria. To switch back to the current record without using the search criteria you enter, click the Form button. (This button replaces the Criteria button as soon you click the Criteria button.)

Deleting records with the data form

In addition to adding and editing records with the data form, you can also delete them. To delete a record, you display its data form and then click the Delete button. Be very careful when deleting records, however, because you can't restore the records you delete with Excel's Undo feature. For this reason, Excel displays an alert dialog box whenever you click the Delete button, indicating that the record displayed in the data form is about to be permanently deleted. To continue and remove the record, you need to click OK or press Enter. To save the current record, press the Esc key or click the Cancel button instead.

REMEMBER Although you can use the Criteria data form to locate a group of records that you want to delete, you can remove only one record at a time with the Delete button.

Eliminating duplicate records

You can use Excel’s Eliminate Duplicates feature to quickly find and remove duplicate records from a list (or rows from a table). This feature is especially useful when you’re dealing with a large table in which several different people do the data entry and that should not have any duplicate records (such as client lists, personnel files, and the like).

To have Excel remove all duplicate records from a table, you follow these simple steps:

1. **Position the cell cursor in one of the cells of the table.**
2. **In the Data tab's Data Tools group, click the Remove Duplicates command (or press Alt+AM).**

   Excel selects all the cells in the table while at the same time displaying the Remove Duplicates dialog box similar to the one shown in Figure 1-3 (sample workbook: Employee data.xlsx).

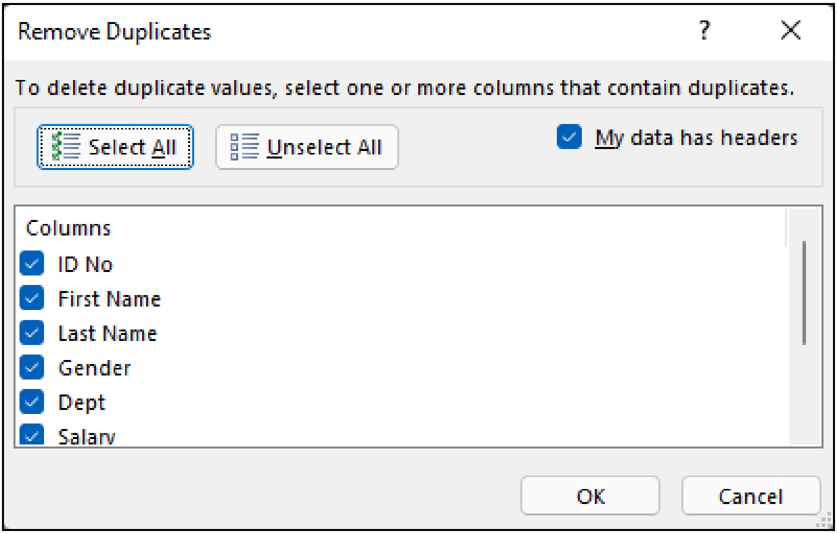
   When this dialog box first opens, Excel automatically selects all the fields in the table (by selecting the check box in front of each name in the Columns list). When all the fields are selected and you click OK in this dialog box, Excel deletes only complete duplicates (in other words, copies) of the records in the list.

   If you want the program to remove records where there’s any duplication of entries in particular fields (such as the ID No field), you remove the check marks from all the columns except for those whose duplication are sufficient reason for deleting the entire record (as described in Step 3). Otherwise, you proceed directly to Step 4.

3. **(Optional) Remove the check marks from all fields in the Columns list box except for those whose duplicates are reason for deleting the record.**

   If only one or two fields out of many need to be selected in the Columns list box, click the Unselect All button to remove the check marks from all field check boxes and then individually click the fields that can't have duplicate entries.

4. **Click OK to have Excel remove the duplicate records (rows) from the selected table.**



Remove Duplicates

To delete duplicate values, select one or more columns that contain duplicates.

☑ My data has headers

Columns

☑ ID No

☑ First Name

☑ Last Name

☑ Gender

☑ Dept

☑ Salary

FIGURE 1-3: Using the Remove Duplicates dialog box to remove duplicate records from a table. (Sample workbook: Employee data.xlsx)

Sorting Table Data

You can use the Home tab's Sort & Filter command and the AutoFilter buttons on a table's field names to quickly sort table data. You can sort the records in your table by sorting its rows, and you can sort the fields in the table by sorting its columns.

REMEMBER In sorting, you can specify either ascending or descending sort order for your data. When you specify ascending order (which is the default), Excel arranges text in A-to-Z order and values from smallest to largest. When you specify descending order, Excel reverses this order and arranges text in Z-to-A order and values range from largest to smallest. When sorting on a date field, ascending order puts the records in oldest to newest order, while descending order gives you the records in newest to oldest date order.

REMEMBER Although sorting is most often applied to rearranging and maintaining table records and fields, you can use the Sort & Filter command button to reorder data in any worksheet range, whether or not the range follows the strict table structure.

TECHNICAL STUFF

MORE ABOUT ASCENDING AND DESCENDING SORT ORDERS

When you use the ascending sort order on a field in a table that contains many different kinds of entries, Excel places numbers (from smallest to largest) before text entries (in alphabetical order), followed by any logical values (FALSE and TRUE), error values, and finally, blank cells. When you use the descending sort order, Excel arranges the different entries in reverse: numbers are still first, arranged from largest to smallest; text entries go from Z to A; and the TRUE logical value precedes the FALSE logical value.

Sorting records on a single field

When you need to sort the table only on one particular field (such as the ID No, Last Name, or Location field), you click that field's AutoFilter button and then select the appropriate sort option from its drop-down list:

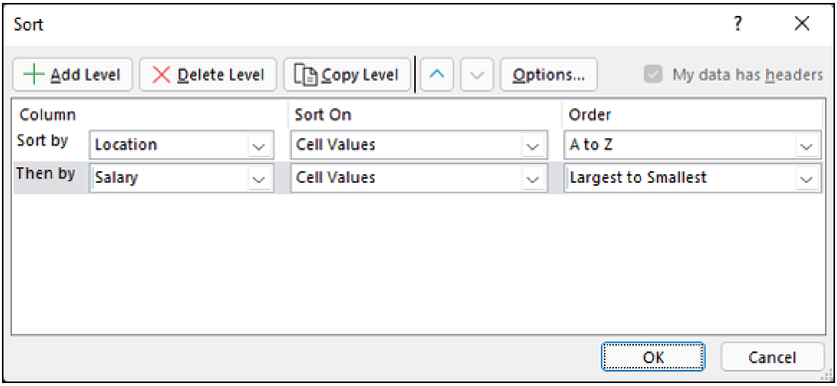
- **Sort A to Z** or **Sort Z to A** in a text field
- **Sort Smallest to Largest** or **Sort Largest to Smallest** in a number field
- **Sort Oldest to Newest** or **Sort Newest to Oldest** in a date field

Excel then reorders all the records in the table in accordance with the new ascending or descending order in the selected field. If you find that you've sorted the list in error, click the Home tab's Undo button or press Ctrl+Z right away to return the list to its previous order.

TIP Excel shows when a field has been used in sorting the table by adding an up or down arrow to its filter button. An arrow pointing up indicates that the ascending sort order was used and one pointing down indicates that the descending sort order was used.

Sorting records on multiple fields

When you need to sort a table on more than one field, you use the Sort dialog box, shown in Figure 1-4 (sample workbook: Employee data.xlsx). And you need to sort on more than one field when the first field contains duplicate values and you want to determine how the records with duplicates are arranged. (If you don't specify another field to sort on, Excel just puts the records in the order in which you entered them.)



	Column	Sort On	Order
Sort by	Location	Cell Values	A to Z
Then by	Salary	Cell Values	Largest to Smallest

FIGURE 1-4: Set up to sort records alphabetically by location and salary. (Sample workbook: Employee data.xlsx)

The best and most common example of when you need more than one field is when sorting a large database alphabetically in last-name order. Say that you have a database that contains several people with the last name Smith, Jones, or Zastrow (as is the case when you work at Zastrow and Sons). If you specify the Last Name field as the only field to sort on (using the default ascending order), all the duplicate Smiths, Joneses, and Zastrows are placed in the order in which their records were originally entered. To better sort these duplicates, you can specify the First Name field as the second field to sort on (again using the default ascending order), making the second field the tiebreaker, so that Ian Smith's record precedes that of Sandra Smith, and Vladimir Zastrow's record comes after that of Mikhail Zastrow.

To sort records in a table using the Sort dialog box, follow these steps:

1. **Position the cell cursor in one of the cells in the table.**
2. **Choose Data⇒ Sort button (or press Alt + ASS).**

   Excel selects all the records of the database (without including the first row of field names) and opens the Sort dialog box, as shown in Figure 1-4. Note that you can also open the Sort dialog box by choosing Home⇒ Sort & Filter⇒ Custom Sort (or by pressing Alt + HSU).
3. **Select the name of the field you first want the records sorted by from the Sort By drop-down list.**

If you want the records arranged in descending order, remember also to select the descending sort option (Z to A, Smallest to Largest, or Oldest to Newest) from the Order drop-down list to the right.

4. **(Optional) If the first field contains duplicates and you want to specify how the records in this field are sorted, click the Add Level button to insert another sort level, select a second field to sort on from the Then By drop-down list, and select either the ascending or descending option from its Order drop-down list to its right.**
5. **(Optional) If necessary, repeat Step 4, adding as many additional sort levels as required.**
6. **Click OK.**

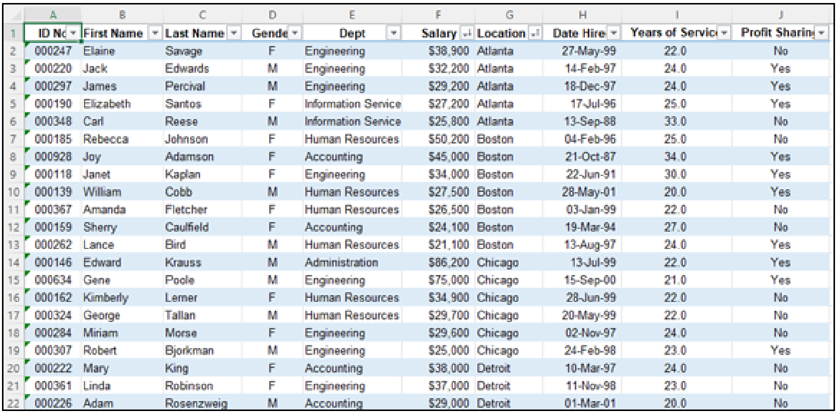
   Excel sorts the records in the table using the sorting fields in the order of their levels in this dialog box. If you see that you sorted the database on the wrong fields or in the wrong order, choose Home⇒ Undo or press Ctrl + Z to immediately restore the table records to their previous order.

TIP By default, when you perform a sort operation, Excel assumes that you're sorting a table that has a header row (with the field names) that is not to be reordered with the rest of the records in doing the sort. You can, however, use the Sort feature to sort a cell selection that doesn't have such a header row. In that case, you need to specify the sorting keys by column letter, and you need to be sure to deselect the My Data Has Headers check box in the Sort dialog box.

Also, the Sort dialog box contains an Options button that, when clicked, opens a Sort Options dialog box, which contains a Case Sensitive check box that, when selected, enables you to sort text fields based on case, where lowercase comes before uppercase. This dialog box also contains options for changing the orientation of the sort from the normal top-to-bottom order to left-to-right order when you want to sort columns in a list.

Figure 1-5 (sample workbook: Employee data.xlsx) illustrates sorting the employee table first in ascending order by location and then in descending order by salary. For this sort, the Location field is designated as the field (column) to sort on in the first level and the Salary field as the other field (column) as the second level. Also, to have the records within each location sorted from highest to lowest salary, I selected Largest to Smallest from the Order drop-down list to the right of the first Then By combo box.

After clicking OK in the Sort dialog box, the records are now organized first in ascending order by the city listed in the Location field (Atlanta, Boston, Chicago, and so on) and within each city in descending order by Salary (38,900, 32,200, 29,200, and so on).



	A	B	C	D	E	F	G	H	I	J
1	ID Nc	First Name	Last Name	Gende	Dept	Salary	Location	Date Hire	Years of Servic	Profit Sharin
2	000247	Elaine	Savage	F	Engineering	$38,900	Atlanta	27-May-99	22.0	No
3	000220	Jack	Edwards	M	Engineering	$32,200	Atlanta	14-Feb-97	24.0	Yes
4	000297	James	Percival	M	Engineering	$29,200	Atlanta	18-Dec-97	24.0	Yes
5	000190	Elizabeth	Santos	F	Information Service	$27,200	Atlanta	17-Jul-96	25.0	Yes
6	000348	Carl	Reese	M	Information Service	$25,800	Atlanta	13-Sep-88	33.0	No
7	000185	Rebecca	Johnson	F	Human Resources	$50,200	Boston	04-Feb-96	25.0	No
8	000928	Joy	Adamson	F	Accounting	$45,000	Boston	21-Oct-87	34.0	Yes
9	000118	Janet	Kaplan	F	Engineering	$34,000	Boston	22-Jun-91	30.0	Yes
10	000139	William	Cobb	M	Human Resources	$27,500	Boston	28-May-01	20.0	Yes
11	000367	Amanda	Fletcher	F	Human Resources	$26,500	Boston	03-Jan-99	22.0	No
12	000159	Sherry	Caulfield	F	Accounting	$24,100	Boston	19-Mar-94	27.0	No
13	000262	Lance	Bird	M	Human Resources	$21,100	Boston	13-Aug-97	24.0	Yes
14	000146	Edward	Krauss	M	Administration	$86,200	Chicago	13-Jul-99	22.0	Yes
15	000634	Gene	Poole	M	Engineering	$75,000	Chicago	15-Sep-00	21.0	Yes
16	000162	Kimberly	Lerner	F	Human Resources	$34,900	Chicago	28-Jun-99	22.0	No
17	000324	George	Tallan	M	Human Resources	$29,700	Chicago	20-May-99	22.0	No
18	000284	Miriam	Morse	F	Engineering	$29,600	Chicago	02-Nov-97	24.0	No
19	000307	Robert	Bjorkman	M	Engineering	$25,000	Chicago	24-Feb-98	23.0	Yes
20	000222	Mary	King	F	Accounting	$38,000	Detroit	10-Mar-97	24.0	No
21	000361	Linda	Robinson	F	Engineering	$37,000	Detroit	11-Nov-98	23.0	No
22	000226	Adam	Rosenzweig	M	Accounting	$29,000	Detroit	01-Mar-01	20.0	No

FIGURE 1-5: Employee table sorted by location and salary. (Sample workbook: Employee data.xlsx)

Sometimes, you may need to sort on a whole bunch of fields to get the desired order. For example, suppose that you're working with a personnel table and you want to organize the records in alphabetical order, first by department, then by supervisor, and finally by last name, first name, and middle name. To sort the records in this table on these five fields, you have to define each of the columns as a separate level in the Sort dialog box as follows:

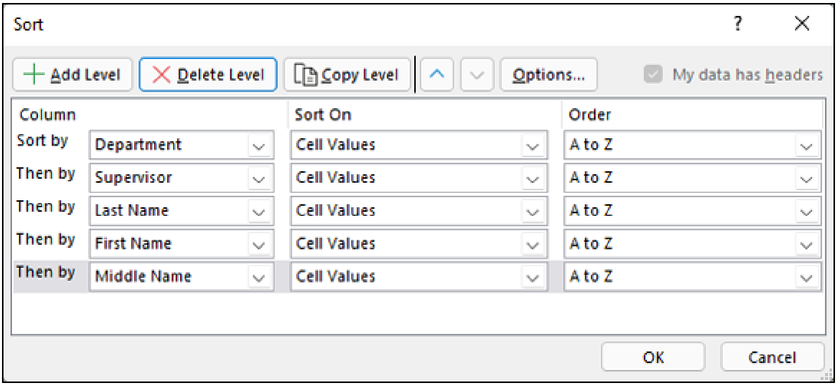
- First by Department field in A to Z order
- Then by Supervisor field in A to Z order
- Then by Last Name field in A to Z order
- Then by First Name field in A to Z order

- Then by Middle Name field in A to Z order

Figure 1-6 (sample workbook: Personnel table.xlsx) shows the Sort dialog box after defining these as the columns on five separate levels on which to sort the personnel table. Figure 1-7 (sample workbook: Personnel table.xlsx) shows the result. After performing this sort operation, the records are now arranged in ascending order by department, then by supervisor within department, and finally by the last name, first name, and middle name under each supervisor.

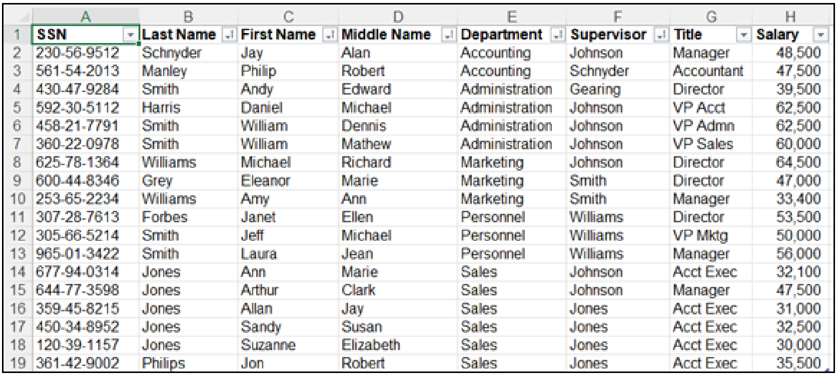
Sorting a table on font and fill colors and cell icons

Although you normally sort the records of a table or rows of a table on the values (entries) contained in one or more columns of the list or table, Excel also enables you to sort on the font or fill color or cell icons that you assign to them as well. These colors and icons are assigned by using the conditional formatting feature to mark those values in the columns of a table or table that are within or outside certain parameters with a distinctive font or fill colors or cell icon. (See the section on the conditional formatting feature in Book 2, Chapter 2 for details.)



Column		Sort On	Order
Sort by	Department	Cell Values	A to Z
Then by	Supervisor	Cell Values	A to Z
Then by	Last Name	Cell Values	A to Z
Then by	First Name	Cell Values	A to Z
Then by	Middle Name	Cell Values	A to Z

FIGURE 1-6: The Sort dialog box with five levels of sorting keys for sorting the Personnel table. (Sample workbook: Personnel table.xlsx)



	A	B	C	D	E	F	G	H
1	SSN	Last Name	First Name	Middle Name	Department	Supervisor	Title	Salary
2	230-56-9512	Schnyder	Jay	Alan	Accounting	Johnson	Manager	48,500
3	561-54-2013	Manley	Philip	Robert	Accounting	Schnyder	Accountant	47,500
4	430-47-9284	Smith	Andy	Edward	Administration	Gearing	Director	39,500
5	592-30-5112	Harris	Daniel	Michael	Administration	Johnson	VP Acct	62,500
6	458-21-7791	Smith	William	Dennis	Administration	Johnson	VP Admn	62,500
7	360-22-0978	Smith	William	Mathew	Administration	Johnson	VP Sales	60,000
8	625-78-1364	Williams	Michael	Richard	Marketing	Johnson	Director	64,500
9	600-44-8346	Grey	Eleanor	Marie	Marketing	Smith	Director	47,000
10	253-65-2234	Williams	Amy	Ann	Marketing	Smith	Manager	33,400
11	307-28-7613	Forbes	Janet	Ellen	Personnel	Williams	Director	53,500
12	305-66-5214	Smith	Jeff	Michael	Personnel	Williams	VP Mktg	50,000
13	965-01-3422	Smith	Laura	Jean	Personnel	Williams	Manager	56,000
14	677-94-0314	Jones	Ann	Marie	Sales	Johnson	Acct Exec	32,100
15	644-77-3598	Jones	Arthur	Clark	Sales	Johnson	Manager	47,500
16	359-45-8215	Jones	Allan	Jay	Sales	Jones	Acct Exec	31,000
17	450-34-8952	Jones	Sandy	Susan	Sales	Jones	Acct Exec	32,500
18	120-39-1157	Jones	Suzanne	Elizabeth	Sales	Jones	Acct Exec	30,000
19	361-42-9002	Philips	Jon	Robert	Sales	Jones	Acct Exec	35,500

FIGURE 1-7: The Personnel table after sorting by department, supervisor, last, first, and finally middle names. (Sample workbook: Personnel table.xlsx)

To sort a table on a font color, fill color, or cell icon in a single field of the table, you click its AutoFilter button and then choose the Sort by Color option from the drop-down menu. Excel then displays a continuation menu on which you click the font color, fill color, or cell icon to use in the sort:

- To sort the records so that those with a particular font color in the selected column — assigned with the Highlight Cell Rules or Top/Bottom Rules options — appear at the top of the table, click its color swatch in the Sort by Font Color section on the continuation menu.
- To sort the records so that those with a particular fill color in the selected column — assigned with the Highlight Cell Rules, Top/Bottom Rules, Data Bars, or Color Scales options — appear at the top of the table, click its color swatch in the Sort by Font Color section on the continuation menu.
- To sort the records so that those with a particular cell icon in the selected column — assigned with the Icon Sets options — appear at the top of the table, click the icon in the Sort by Cell Icon section of the continuation menu.

You can also sort the table on more than one color or cell icon in the Sort dialog box opened by selecting the Custom Sort option from the Sort & Filter button's drop-down list on the Ribbon's Home tab or on the Sort by Color continuation menu.

When you want to sort the records in a table on more than one font or fill color or cell icon, you select the field with the color or icon from the Column drop-down list; select Font Color, Fill Color, or Cell Icon in the Sort On drop-down list; and then click the color swatch or icon to use in the first level of the sort in the Order drop-down list.

If you need to add another sort level, you click the Add Level button and then repeat this procedure of selecting the field in the Column drop-down list, selecting the Font Color, Fill Color, or Cell Icon in the Sort On drop-down list, and selecting the specific color or icon in the Order drop-down list. When you finish defining all the levels for the sort, click OK to have Excel go ahead and sort the list's records.

REMEMBER You can sort the records in the table order by all the fill colors or cell icons assigned by applying the Conditional Formatting Color Scales and Cell Icons options. For each of three or five sorting levels you define in the Sort dialog box, the name of the field in the Column drop-down list button remains the same in all levels along with the Fill Color or Cell Icon option in the Sort On drop-down list button. Only the actual color or icon selected in the Order drop-down list button changes, reflecting the order in which you want to see the records appear in the sorted table.

Subtotaling Table Data

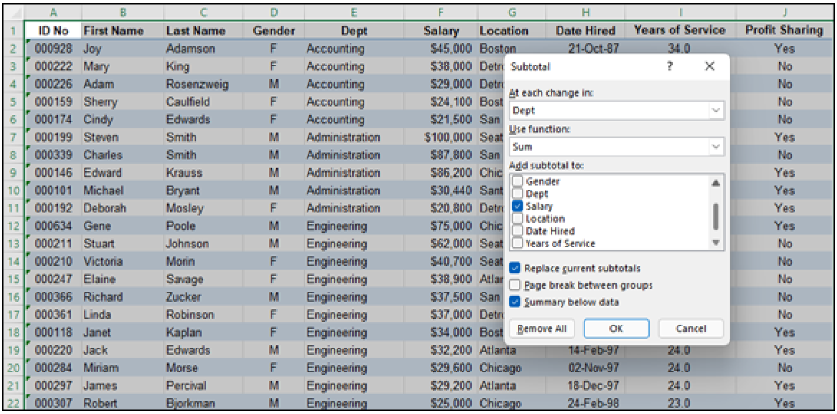
You can use Excel's Subtotals feature to subtotal data in a *sorted* table. You sort the list on the field for which you want subtotals shown before you designate the field that contains the values you want subtotaled — these are almost always not the same fields in the table.

For example, to subtotal the salaries within each department in the sample Employee table (sample workbook: Employee data.xlsx), you first sort the list in A-to-Z order on the Dept column. Then, you designate this Dept field as the one for which you want the subtotals calculated (so that a subtotal appears at each change in department) and the Salary field as the one to be subtotaled so that Excel uses the SUM function on its data entries.

REMEMBER When you use the Subtotals feature, you aren’t restricted to having the values in the designated field added together with the SUM function. You can instead have Excel return the number of entries with the COUNT function, the average of the entries with the AVERAGE function, the highest entry with the MAXIMUM function, the lowest entry with the MINIMUM function, or even the product of the entries with the PRODUCT function.

WARNING Excel doesn’t allow you to subtotal a table formatted as a table. Before you can use the Subtotal command button, you must first convert your table into a normal range of cells. To do this, click a cell in the table and then click the Design tab on the Table Tools contextual tab on the Ribbon. Finally, click the Convert to Range command button in the Tools group followed by the Yes button in the alert dialog box asking you to confirm this action. Excel then removes the filter buttons from the columns at the top of the table while still retaining the original table formatting.

Figures 1-8 and 1-9 (sample workbook for both: Employee data.xlsx) illustrate how to use the Subtotals feature to obtain totals in a table. In Figure 1-8, I sorted the sample Employee table first by the Dept field in ascending order and then by the Salary field in descending order (Largest to Smallest) and converted the table to a range (by choosing Table Design⇒ Convert to Range). Then, in the Data tab's Outline group, I clicked the Subtotal command to open the Subtotal dialog box shown in Figure 1-8.



1	ID No	First Name	Last Name	Gender	Dept	Salary	Location	Date Hired	Years of Service	Profit Sharing
2	000928	Joy	Adamson	F	Accounting	$45,000	Boston	21-Oct-87	34.0	Yes
3	000222	Mary	King	F	Accounting	$38,000	Detr			No
4	000226	Adam	Rosenzweig	M	Accounting	$29,000	Detr			No
5	000159	Sherry	Caulfield	F	Accounting	$24,100	Bost			No
6	000174	Cindy	Edwards	F	Accounting	$21,500	San			No
7	000199	Steven	Smith	M	Administration	$100,000	Seat			Yes
8	000339	Charles	Smith	M	Administration	$87,800	San			No
9	000146	Edward	Krauss	M	Administration	$86,200	Chic			Yes
10	000101	Michael	Bryant	M	Administration	$30,440	Sant			Yes
11	000192	Deborah	Mosley	F	Administration	$20,800	Detr			Yes
12	000634	Gene	Poole	M	Engineering	$75,000	Chic			Yes
13	000211	Stuart	Johnson	M	Engineering	$62,000	Seat			No
14	000210	Victoria	Morin	F	Engineering	$40,700	Seat			No
15	000247	Elaine	Savage	F	Engineering	$38,900	Atlar			No
16	000366	Richard	Zucker	M	Engineering	$37,500	San			No
17	000361	Linda	Robinson	F	Engineering	$37,000	Detr			No
18	000118	Janet	Kaplan	F	Engineering	$34,000	Bost			Yes
19	000220	Jack	Edwards	M	Engineering	$32,200	Atlanta	14-Feb-97	24.0	Yes
20	000284	Miriam	Morse	F	Engineering	$29,600	Chicago	02-Nov-97	24.0	No
21	000297	James	Percival	M	Engineering	$29,200	Atlanta	18-Dec-97	24.0	Yes
22	000307	Robert	Bjorkman	M	Engineering	$25,000	Chicago	24-Feb-98	23.0	Yes

Subtotal

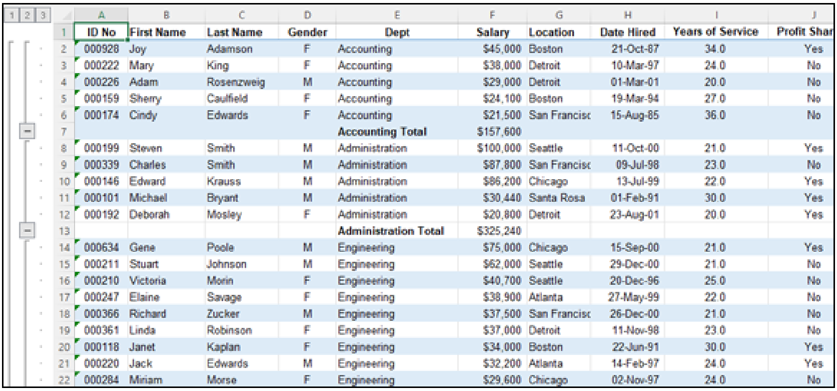
At each change in: Dept

Use function: Sum

Add subtotal to:
☐ Gender
☐ Dept
☑ Salary
☐ Location
☐ Date Hired
☐ Years of Service

☑ Replace current subtotals
☐ Page break between groups
☑ Summary below data

FIGURE 1-8: Using the Subtotal dialog box to subtotal the salaries for each department. (Sample workbook: Employee data.xlsx)



1	ID No	First Name	Last Name	Gender	Dept	Salary	Location	Date Hired	Years of Service	Profit Shar
2	000928	Joy	Adamson	F	Accounting	$45,000	Boston	21-Oct-87	34.0	Yes
3	000222	Mary	King	F	Accounting	$38,000	Detroit	10-Mar-97	24.0	No
4	000226	Adam	Rosenzweig	M	Accounting	$29,000	Detroit	01-Mar-01	20.0	No
5	000159	Sherry	Caulfield	F	Accounting	$24,100	Boston	19-Mar-94	27.0	No
6	000174	Cindy	Edwards	F	Accounting	$21,500	San Francisc	15-Aug-85	36.0	No
7					**Accounting Total**	$157,600				
8	000199	Steven	Smith	M	Administration	$100,000	Seattle	11-Oct-00	21.0	Yes
9	000339	Charles	Smith	M	Administration	$87,800	San Francisc	09-Jul-98	23.0	No
10	000146	Edward	Krauss	M	Administration	$86,200	Chicago	13-Jul-99	22.0	Yes
11	000101	Michael	Bryant	M	Administration	$30,440	Santa Rosa	01-Feb-91	30.0	Yes
12	000192	Deborah	Mosley	F	Administration	$20,800	Detroit	23-Aug-01	20.0	Yes
13					**Administration Total**	$325,240				
14	000634	Gene	Poole	M	Engineering	$75,000	Chicago	15-Sep-00	21.0	Yes
15	000211	Stuart	Johnson	M	Engineering	$62,000	Seattle	29-Dec-00	21.0	No
16	000210	Victoria	Morin	F	Engineering	$40,700	Seattle	20-Dec-96	25.0	No
17	000247	Elaine	Savage	F	Engineering	$38,900	Atlanta	27-May-99	22.0	No
18	000366	Richard	Zucker	M	Engineering	$37,500	San Francisc	26-Dec-00	21.0	No
19	000361	Linda	Robinson	F	Engineering	$37,000	Detroit	11-Nov-98	23.0	No
20	000118	Janet	Kaplan	F	Engineering	$34,000	Boston	22-Jun-91	30.0	Yes
21	000220	Jack	Edwards	M	Engineering	$32,200	Atlanta	14-Feb-97	24.0	Yes
22	000284	Miriam	Morse	F	Engineering	$29,600	Chicago	02-Nov-97	24.0	No

FIGURE 1-9: Bottom of the table showing the subtotals and grand total for department salaries. (Sample workbook: Employee data.xlsx)

Here, I selected the Dept field as the field for which the subtotals are to be calculated in the At Each Change In drop-down list box, Sum as the function to use in the Use Function drop-down list box, and the Salary check box as the field whose values are to be summed in the Add Subtotal To list box.

Figure 1-9 shows the results I obtained after clicking OK in the Subtotal dialog box. Here, you see the bottom of the table showing the salary subtotals for the Administration, Engineering, Human Resources, and Information Services departments along with the grand total of the salaries for all the departments. The grand total is displayed at the bottom of the table because I left the Summary below Data check box selected in the Subtotal dialog box — if I hadn't wanted a grand total, I would have removed the check mark from this check box.

As you can see in Figure 1-9, when you use the Subtotals command, Excel outlines the data and adds the rows with the departmental salary totals and the grand total. This means that you can collapse the table down to just its departmental subtotal rows or even just the grand total row by collapsing the outline down to the second or first level. (Remember that you can toggle between showing and hiding the outline symbols at the left edge of the table by pressing Ctrl+8.)

TIP In a large table, you may want Excel to insert page breaks (often referred to as *breaks*) every time data changes in the field on which the list is being subtotaled (that is, the field designated in the At Each Change In drop-down list box). To do this, you select the Page Break between Groups check box in the Subtotal dialog box to put a check mark in it before you click OK to subtotal the list.

Chapter 2

Filtering and Querying a Table

IN THIS CHAPTER

- **Understanding how to filter and query a table**
- **Using AutoFilter to show only the data you want to see**
- **Filtering a table with custom criteria**
- **Filtering a table on font color, fill color, or cell icons**
- **Using database functions to compute statistics from records that match your filter criteria**
- **Performing external data queries with text files, web pages, and data files kept in other database sources**

It's one thing to set up a table and load it with tons of data and quite another to get just the information that you need out of that table. How you go about extracting the data that's important to you is the subject of this chapter. The process for specifying the subset of the data that you want displayed in an Excel table is called *filtering* the table. The process for extracting only the data that you want from the table is called *querying* the table.

Besides helping you with filtering and querying the data in your table, this chapter also explains how you can use Excel's database functions to perform calculations on numeric fields for only the records that meet the criteria that you specify. These calculations can include getting the total (DSUM), the average (DAVERAGE), the record count (DCOUNT and DCOUNTA), and the like.

Finally, this chapter introduces you to querying an external data source to bring some or all of its data into the more familiar worksheet setting. Data sources can be in the form of external databases in other Windows database programs, such as Microsoft Access or in even more sophisticated, server-based database-management systems, such as those provided by SQL Server, Azure SQL Database, and ODBC connections. They can also be in the form of tables stored on web pages and in text files, which can be parsed into separate cells of an Excel worksheet.

Filtering Data

Filtering the table to leave behind only the information that you want to work with is exactly the procedure that you follow in Excel. At the most basic level, you use the AutoFilter feature to temporarily hide the display of unwanted records and leave behind only the records that you want to see. Much of the time, the capabilities of the AutoFilter feature are all that you need, especially when your main concern is displaying just the information of interest in the table.

You'll encounter situations, however, in which the AutoFilter feature isn't sufficient, and you must do what Microsoft refers to as *advanced filtering* in your table. You need to use advanced filtering when you use computed criteria (such as when you want to see all the records where the entry in the Sales column is twice the amount in the Owed column) and when you need to save a copy of the filtered data in a different part of the worksheet (Excel’s version of querying the data in a table).

Using AutoFilter

Excel’s AutoFilter feature makes filtering out unwanted data in a table as easy as clicking the AutoFilter button on the column on which you want to filter the data and then choosing the appropriate filtering criteria from that column’s drop-down menu.

TIP If you open a worksheet with a table and you don’t find AutoFilter buttons attached to each of the field names at the top of the list, you can display them by positioning the cell pointer in one of the cells with the field names and then clicking the Filter command button on the Ribbon’s Data tab or pressing Ctrl + Shift + L or Alt + AT.

The filter options on a column’s AutoFilter drop-down menu depend on the type of entries in the field. On the drop-down menu in a column that contains only date entries, the menu contains a Date Filters option to which a submenu of the actual filters is attached. On the drop-down menu in a column that contains only numeric entries (besides dates) or a mixture of dates with other types of numeric entries, the menu contains a Number Filters option. On the drop-down menu in a column that contains only text entries or a mixture of text, date, and other numeric entries, the menu contains a Text Filters option.

Doing basic filtering by selecting specific field entries

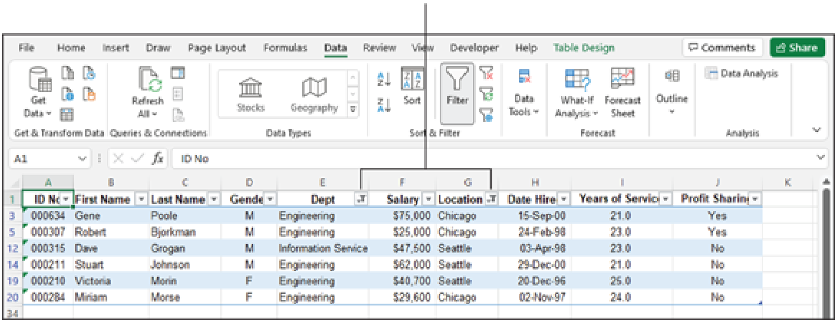
Besides the Date Filters, Text Filters, or Number Filters options (depending on the type of field), the AutoFilter drop-down menu for each field in the table contains a list box with a complete listing of the unique entries made in that column, each with its own check box. At the most basic level, you can filter the table by clearing the check box for all the entries whose records you don't want to see in the list.

TIP This kind of basic filtering works best in fields such as City, State, or Country, which contain many duplicates, so you can see a subset of the table that contains only the cities, states, or countries you want to work with at the time.

The easiest way to perform this basic type of filtering on a field is to first deselect the (Select All) check box at the top of the field's list box, and then select each of the check boxes containing the entries for the records you do want displayed in the filtered table. After you finish selecting the check boxes for all the entries you want to keep, click OK to close the AutoFilter drop-down menu.

Excel then hides rows in the table for all records except for those that contain the entries you just selected. The program also lets you know which field or fields have been used in the filtering operation by adding a cone filter icon to the column's AutoFilter button. To restore all the records to the table, you can remove the filtering by clicking the Clear command button in the Sort & Filter group of the Data tab of the Ribbon or by pressing Alt+AC.

When doing this basic kind of table filtering, you can select specific entries from more than one field in this list. Figure 2-1 (sample workbook: Employee Table.xlsx) illustrates this kind of situation. Here, I want only the employees in the company who work in the Engineering and Information Services departments in the Chicago and Seattle offices. To do this, I selected only the Engineering and Information Services entries in the list box on the Dept field's AutoFilter drop-down menu and only the Chicago and Seattle entries in the list box on the Location field's AutoFilter drop-down menu.



AutoFilter buttons with filter icons

File
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Developer
Help
Table Design
Comments
Share
Get Data
Refresh All
Stocks
Geography
Sort
Filter
Data Tools
What-If Analysis
Forecast Sheet
Outline
Data Analysis
Get & Transform Data
Queries & Connections
Data Types
Sort & Filter
Forecast
Analysis
A1
ID No

	A	B	C	D	E	F	G	H	I	J
1	ID No	First Name	Last Name	Gende	Dept	Salary	Location	Date Hire	Years of Servic	Profit Sharin
3	000634	Gene	Poole	M	Engineering	$75,000	Chicago	15-Sep-00	21.0	Yes
5	000307	Robert	Bjorkman	M	Engineering	$25,000	Chicago	24-Feb-98	23.0	Yes
12	000315	Dave	Grogan	M	Information Service	$47,500	Seattle	03-Apr-98	23.0	No
14	000211	Stuart	Johnson	M	Engineering	$62,000	Seattle	29-Dec-00	21.0	No
19	000210	Victoria	Morin	F	Engineering	$40,700	Seattle	20-Dec-96	25.0	No
20	000284	Miriam	Morse	F	Engineering	$29,600	Chicago	02-Nov-97	24.0	No
34										

FIGURE 2-1: The employee table after filtering the Dept and Location fields. (Sample workbook: Employee Table.xlsx)

As you can see in Figure 2-1, after filtering the Employee table so that only the records for employees in either the Engineering or Information Services department in either the Chicago or Seattle office locations are listed, Excel adds the cone filter icon to the AutoFilter buttons on both the Dept and Location fields in the top row, indicating that the table is filtered using criteria involving both fields.

Using the Text Filters options

The AutoFilter drop-down menu for a field that contains only text or a combination of text, date, and numeric entries contains a Text Filters option that displays a submenu containing the following options:

- **Equals:** Opens the Custom AutoFilter dialog box with the Equals operator selected in the first condition.
- **Does Not Equal:** Opens the Custom AutoFilter dialog box with the Does Not Equal operator selected in the first condition.
- **Begins With:** Opens the Custom AutoFilter dialog box with the Begins With operator selected in the first condition.
- **Ends With:** Opens the Custom AutoFilter dialog box with the Ends With operator selected in the first condition.
- **Contains:** Opens the Custom AutoFilter dialog box with the Contains operator selected in the first condition.
- **Does Not Contain:** Opens the Custom AutoFilter dialog box with the Does Not Contain operator selected in the first condition.

- **Custom Filter:** Opens the Custom AutoFilter dialog box where you can select your own criteria for applying more complex AND or OR conditions.

Using the Date Filters options

The AutoFilter drop-down menu for a field that contains only date entries contains a Date Filters option that displays a submenu containing the following options:

- **Equals:** Opens the Custom AutoFilter dialog box with the Equals operator selected in the first condition.
- **Before:** Opens the Custom AutoFilter dialog box with the Is Before operator selected in the first condition.
- **After:** Opens the Custom AutoFilter dialog box with the Is After operator selected in the first condition.
- **Between:** Opens the Custom AutoFilter dialog box with the Is After or Equal To operator selected in the first condition and the Is Before or Equal To operator selected in the second AND condition.
- **Tomorrow:** Filters the table so that only records with tomorrow's date in this field are displayed in the worksheet.
- **Today:** Filters the table so that only records with the current date in this field are displayed in the worksheet.
- **Yesterday:** Filters the table so that only records with yesterday's date in this field are displayed in the worksheet.
- **Next Week:** Filters the table so that only records with date entries in the week ahead in this field are displayed in the worksheet.
- **This Week:** Filters the table so that only records with date entries in the current week in this field are displayed in the worksheet.
- **Last Week:** Filters the table so that only records with date entries in the previous week in this field are displayed in the worksheet.
- **Next Month:** Filters the table so that only records with date entries in the month ahead in this field are displayed in the worksheet.
- **This Month:** Filters the table so that only records with date entries in the current month in this field are displayed in the worksheet.
- **Last Month:** Filters the table so that only records with date entries in the previous month in this field are displayed in the worksheet.

- **Next Quarter:** Filters the table so that only records with date entries in the three-month quarterly period ahead in this field are displayed in the worksheet.
- **This Quarter:** Filters the table so that only records with date entries in the current three-month quarterly period in this field are displayed in the worksheet.
- **Last Quarter:** Filters the table so that only records with date entries in the previous three-month quarterly period in this field are displayed in the worksheet.
- **Next Year:** Filters the table so that only records with date entries in the calendar year ahead in this field are displayed in the worksheet.
- **This Year:** Filters the table so that only records with date entries in the current calendar year in this field are displayed in the worksheet.
- **Last Year:** Filters the table so that only records with date entries in the previous calendar year in this field are displayed in the worksheet.
- **Year to Date:** Filters the table so that only records with date entries in the current year up to the current date in this field are displayed in the worksheet.
- **All Dates in the Period:** Filters the table so that only records with date entries in the quarter (Quarter 1 through Quarter 4) or month (January through December) that you choose from its submenu are displayed in the worksheet.
- **Custom Filter:** Opens the Custom AutoFilter dialog box where you can select your own criteria for more complex AND or OR conditions.

TIP When selecting dates for conditions using the Equals, Before, or After operator in the Custom AutoFilter dialog box, you can select the date by clicking the Date Picker button (the one with the calendar icon) and then clicking the specific date on the drop-down date palette. When you open the date palette, it shows the current month and the current date selected. To select a date in an earlier month, click the

Previous button (the one with the triangle pointing left) until its month is displayed in the palette. To select a date in a later month, click the Next button (the one with the triangle pointing right) until its month is displayed in the palette.

Using the Number Filters options

The AutoFilter drop-down menu for a field that contains only numeric entries besides dates or a combination of dates and other numeric entries contains a Number Filters option that displays a submenu containing the following options:

- **Equals:** Opens the Custom AutoFilter dialog box with the Equals operator selected in the first condition.
- **Does Not Equal:** Opens the Custom AutoFilter dialog box with the Does Not Equal operator selected in the first condition.
- **Greater Than:** Opens the Custom AutoFilter dialog box with the Is Greater Than operator selected in the first condition.
- **Greater Than or Equal To:** Opens the Custom AutoFilter dialog box with the Is Greater Than or Equal To operator selected in the first condition.
- **Less Than:** Opens the Custom AutoFilter dialog box with the Is Less Than operator selected in the first condition.
- **Less Than or Equal To:** Opens the Custom AutoFilter dialog box with the Is Less Than or Equal to operator selected in the first condition.
- **Between:** Opens the Custom AutoFilter dialog box with the Is Greater Than or Equal To operator selected in the first condition and the Is Less Than or Equal To operator selected in the second AND condition.
- **Top 10:** Opens the Top 10 AutoFilter dialog box so that you can filter the table to just the ten or so top or bottom values or percentages in the field. (See “Making it to the Top Ten!” that follows in this chapter for details.)
- **Above Average:** Filters the table to display only records where the values in the field are greater than the average of the values in this field.
- **Below Average:** Filters the table to display only records where the values in the field are less than the average of the values in this field.

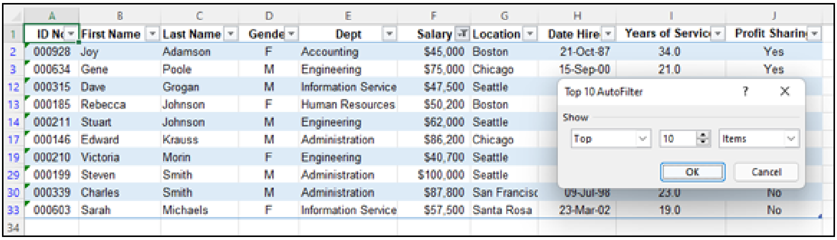
- **Custom Filter:** Opens the Custom AutoFilter dialog box where you can select your own criteria for more complex AND or OR conditions.

Making it to the Top Ten!

The Top Ten option on the Number Filters option's submenu enables you to filter out all records except those whose entries in that field are at the top or bottom of the table by a certain number (10 by default) or in a certain top or bottom percent (10 by default). You can only use the Top Ten item in numerical fields and date fields; this kind of filtering doesn't make any sense when you're dealing with entries in a text field.

When you click the Top Ten option on the Number Filters option's submenu, Excel opens the Top 10 AutoFilter dialog box where you can specify your filtering criteria. By default, the Top 10 AutoFilter dialog box is set to filter out all records except those whose entries are among the top ten items in the field by selecting Top in the drop-down list box on the left, 10 in the middle combo box, and Items in the drop-down list box on the right. If you want to use these default criteria, you click OK in the Top 10 AutoFilter dialog box.

Figure 2-2 (sample workbook: Employee Table.xlsx) shows you the sample employee table after using the Top 10 Items AutoFilter to display only the records with the top ten salaries in the table.



	A	B	C	D	E	F	G	H	I	J
1	ID Nc	First Name	Last Name	Gende	Dept	Salary	Location	Date Hire	Years of Servic	Profit Sharin
2	000928	Joy	Adamson	F	Accounting	$45,000	Boston	21-Oct-87	34.0	Yes
3	000634	Gene	Poole	M	Engineering	$75,000	Chicago	15-Sep-00	21.0	Yes
12	000315	Dave	Grogan	M	Information Service	$47,500	Seattle			
13	000185	Rebecca	Johnson	F	Human Resources	$50,200	Boston			
14	000211	Stuart	Johnson	M	Engineering	$62,000	Seattle			
17	000146	Edward	Krauss	M	Administration	$86,200	Chicago			
19	000210	Victoria	Morin	F	Engineering	$40,700	Seattle			
29	000199	Steven	Smith	M	Administration	$100,000	Seattle			
30	000339	Charles	Smith	M	Administration	$87,800	San Francisc	09-Jul-98	23.0	No
33	000603	Sarah	Michaels	F	Information Service	$57,500	Santa Rosa	23-Mar-02	19.0	No
34										

Top 10 AutoFilter

Show: Top | 10 | Items

FIGURE 2-2: Using the Top 10 Items AutoFilter to filter out all records except for those with the top ten salaries. (Sample workbook: Employee Table.xlsx)

You can also change the filtering criteria in the Top 10 AutoFilter dialog box before you filter the data. You can choose between Top and Bottom in the leftmost drop-down list box and between Items and Percent in the rightmost one. You can also change the number in the middle combo box by clicking it and entering a new value or using the spinner buttons to select one.

Filtering a table on a field's font and fill colors or cell icons

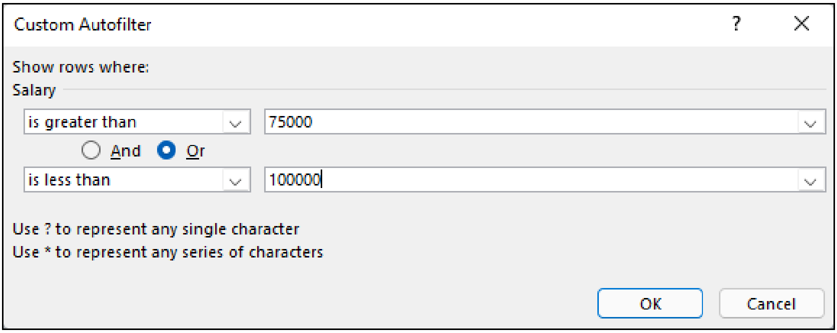
Just as you can sort a table using the font or fill color or cell icons that you've assigned with the Conditional Formatting feature to values in the field that are within or outside of certain parameters (see the section on the Conditional Formatting feature in Book 2, Chapter 2 for details), you can also filter the table.

To filter a table on a font color, fill color, or cell icon used in a field, you click its AutoFilter button and then select the Filter by Color option from the drop-down menu. Excel then displays a submenu from which you choose the font color, fill color, or cell icon to use in the sort:

- To filter the table so that only the records with a particular font color in the selected field — assigned with the Conditional Formatting Highlight Cell Rules or Top/Bottom Rules options — appear in the table, click its color swatch in the Filter by Font Color submenu.
- To filter the table so that only the records with a particular fill color in the selected field — assigned with the Conditional Formatting Highlight Cell Rules, Top/Bottom Rules, Data Bars, or Color Scales options — appear in the table, click its color swatch in the Filter by Font Color submenu.
- To filter the table so that only the records with a particular cell icon in the selected field — assigned with the Conditional Formatting Icon Sets options — appear in the table, click the icon in the Filter by Cell Icon submenu.

Custom AutoFilter at your service

You can click the Custom Filter option on a field's Text Filters, Date Filters, or Number Filters continuation menu to open the Custom AutoFilter dialog box, where you can specify your own filtering criteria by using conditions with the AND or OR logical operators (called AND OR conditions for short). When you click the Custom Filter option, Excel opens the Custom AutoFilter dialog box, similar to the one shown in Figure 2-3 (sample workbook: Employee Table.xlsx).


Custom Autofilter

Show rows where:

Salary

is greater than 75000

○ And ● Or

is less than 100000

Use ? to represent any single character

Use * to represent any series of characters

FIGURE 2-3: Using Custom AutoFilter to filter out records except for those within a range of salaries. (Sample workbook: Employee Table.xlsx)

Here, you select the type of operator to use in evaluating the first and second conditions in the top and bottom drop-down list boxes and the values to be evaluated in the first and second conditions in the associated combo boxes. You also specify the type of relationship between the two conditions with the And option button. (The And option button is selected by default.)

When selecting the operator for the first and second condition in the leftmost drop-down list boxes at the top and bottom of the Custom AutoFilter dialog box, you have the following choices, depending on the types of entries in the selected field:

- **Equals:** Matches records where the entry in the field is identical to the text, date, or number you enter in the associated combo box.
- **Does Not Equal:** Matches records where the entry in the field is anything other than the text, date, or number you enter in the associated combo box.
- **Is After:** Matches records where the entry in the date field comes after the date you enter or select in the associated combo box.
- **Is After or Equal To:** Matches records where the entry in the date field comes after or is the same as the date you enter or select in the associated combo box.
- **Is Before:** Matches records where the entry in the date field precedes the date you enter or select in the associated combo box.
- **Is Before or Equal To:** Matches records where the entry in the date field precedes or is the same as the date you enter or select in the associated combo box.
- **Is Greater Than:** Matches records where the entry in the field

follows the text in the alphabet, comes after the date, or is larger than the number you enter in the associated combo box.

- **Is Greater Than or Equal To:** Matches records where the entry in the field follows the text in the alphabet or is identical, the date comes after or is identical, or the number is larger than or equal to the one you enter in the associated combo box.
- **Is Less Than:** Matches records where the entry in the field comes before the text in the alphabet, comes before the date, or is less than the number you enter in the associated combo box.
- **Is Less Than or Equal To:** Matches records where the entry in the field comes before the text in the alphabet or is identical, the date comes before or is identical, or the number is less than or equal to the one you enter in the associated combo box.
- **Begins With:** Matches records where the entry in the field starts with the text, the part of the date, or the number you enter in the associated combo box.
- **Does Not Begin With:** Matches records where the entry in the field starts with anything other than the text, the part of the date, or the number you enter in the associated combo box.
- **Ends With:** Matches records where the entry in the field ends with the text, the part of the date, or the number you enter in the associated combo box.
- **Does Not End With:** Matches records where the entry in the field ends with anything other than the text, the part of the date, or the number you enter in the associated combo box.
- **Contains:** Matches records where the entry in the field contains the text, the part of the date, or the number you enter in the associated combo box.
- **Does Not Contain:** Matches records where the entry in the field contains anything other than the text, the part of the date, or the number you enter in the associated combo box.

REMEMBER Note that you can use the Begins With, Ends With, and Contains operators and their negative counterparts when filtering a text field — you can also use the question mark (?)

and asterisk (*) wildcard characters when entering the values for use with these operators. (The question mark wildcard stands for individual characters, and the asterisk stands for one or more characters.) You use the other logical operators when dealing with numeric and date fields.

When specifying the values in the associated combo boxes on the right side of the Custom AutoFilter dialog box, you can type the text, number, or date, or you can select an existing field entry by clicking the box's drop-down list button and then clicking the entry on the drop-down menu. In date fields, you can select the dates directly from the date drop-down palette opened by clicking the box's Date Picker button (the one with the calendar icon).

Figure 2-3 illustrates setting up filtering criteria in the Custom AutoFilter dialog box that selects records whose Salary values fall within two separate ranges of values. In this example, I'm using an OR condition to filter out all records where the salaries fall below $100,000 or are greater than $75,000 by entering the following complex condition:

```
Salary Is Greater Than 75000 OR Is Less Than 100000
```

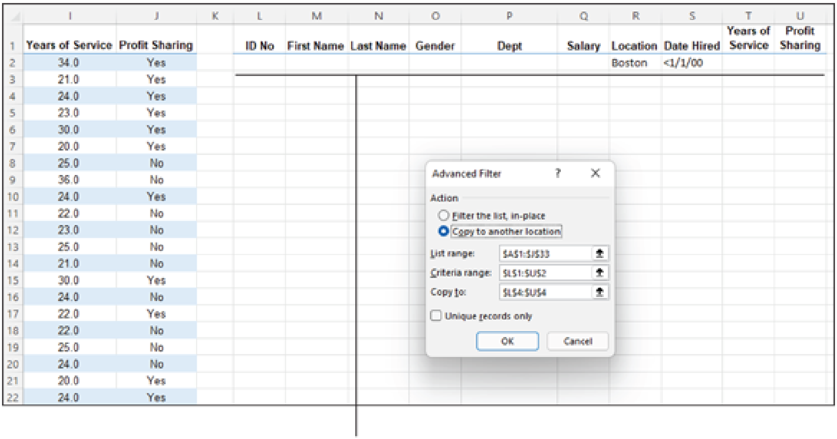
Using the Advanced Filter

When you use advanced filtering, you don't use the field's AutoFilter buttons and associated drop-down menu options. Instead, you create a so-called *criteria range* somewhere on the worksheet that contains the table to be filtered before opening the Advanced Filter dialog box.

When you use the Advanced Filter feature to do a query, you extract copies of the records that match your criteria by creating a subset of the table. You can locate the criteria range to the right of the table and then specify the Copy To range underneath the criteria range, similar to the arrangement shown in Figure 2-4 (sample workbook: Employee Table with Criteria Range.xlsx).

To create a criteria range, you copy the names of the fields in the table to a new part of the worksheet and then enter the values (text, numbers, or formulas) that are to be used as the criteria in filtering the table in rows underneath. When setting up the criteria for filtering the table, you can create either comparison criteria or calculated criteria.

After you've set up your criteria range with all the field names and the criteria that you want used, you click the Data tab's Advanced command (or press Alt+AQ) to open the Advanced Filter dialog box similar to the one shown in Figure 2-4. Here, you specify whether you just want to filter the records in the table (by hiding the rows of all those that don't meet your criteria) or you want to copy the records that meet your criteria to a new area in the worksheet (by creating a subset of the table).



	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	Years of Service	Profit Sharing		ID No	First Name	Last Name	Gender	Dept	Salary	Location	Date Hired	Years of Service	Profit Sharing
2	34.0	Yes								Boston	<1/1/00		
3	21.0	Yes											
4	24.0	Yes											
5	23.0	Yes											
6	30.0	Yes											
7	20.0	Yes											
8	25.0	No											
9	36.0	No											
10	24.0	Yes											
11	22.0	No											
12	23.0	No											
13	25.0	No											
14	21.0	No											
15	30.0	Yes											
16	24.0	No											
17	22.0	Yes											
18	22.0	No											
19	25.0	No											
20	24.0	No											
21	20.0	Yes											
22	24.0	Yes											

Advanced Filter

Action

○ Filter the list, in-place

● Copy to another location

List range: $A$1:$J$33

Criteria range: $L$1:$U$2

Copy to: $L$4:$U$4

☐ Unique records only

Criteria range

FIGURE 2-4: Using Advanced Filter to copy records that meet the criteria in the Criteria Range. (Sample workbook: Employee Table with Criteria Range.xlsx)

To just filter the data in the table, leave the Filter the List, In-Place option button selected. To query the table and copy the data to a new place in the same worksheet (note that the Advanced Filter feature doesn't let you copy the data to another sheet or workbook), you select the Copy to Another Location option button. When you select this option button, the Copy To text box becomes available, along with the List Range and Criteria Range text boxes.

To specify the table that contains the data that you want to filter or query, click the List Range text box and then enter the address of the cell range or select it directly in the worksheet by dragging through its cells. To specify the range that contains a copy of the field names along with the criteria entered under the appropriate fields, you click the Criteria Range text box and then enter the range address of this cell range or select it directly in the worksheet by dragging through its cells. When selecting this range, be sure that you include all the rows that contain the values that you want evaluated in the filter or query.

ONLY THE UNIQUE NEED APPLY!

To filter out duplicate rows or records that match your criteria, select the Unique Records Only check box in the Advanced Filter dialog box. You can remove the display of all duplicate records from a table by selecting this check box and removing all cell references from the Criteria Range text box before you click OK.

If you're querying the table by copying the records that meet your criteria to a new part of the worksheet (indicated by clicking the Copy to Another Location option button), you also click the Copy To text box and then enter the address of the cell that is to form the upper-left corner of the copied and filtered records or click this cell directly in the worksheet.

After specifying whether to filter or query the data and designating the ranges to be used in this operation, click OK to have Excel apply the criteria that you've specified in the criteria range in either filtering or copying the records.

After filtering a table, you may feel that you haven't received the expected results — for example, no records are listed under the field names that you thought should have several. You can bring back all the records in the table by clicking the Data tab's Clear command or by pressing Alt+AC. Now you can fiddle with the criteria in the criteria range text box and try the whole advanced filtering thing all over again.

Specifying comparison criteria

Entering selection criteria in the Criteria Range for advanced filtering is very similar to entering criteria in the data form after selecting the Criteria button. However, you need to be aware of some differences. For example, if you are searching for the last name *Paul* and enter the label **Paul** in the criteria range under the cell containing the field name Last Name, Excel matches any last name that begins with *P-a-u-l* such as Pauley, Paulson, and so on. To avoid having Excel match any other last name beside Paul, you would have to enter a formula in the cell below the one with the Last Name field name, as in

```
="Paul"
```

When entering criteria for advanced filtering, you can also use the question mark (?) or the asterisk (*) wildcard character in your selection criteria just like you do when using the data form to find records. If, for example, you enter **J*n** under the cell with the First Name field name, Excel considers any characters between *J* and *n* in the First Name field to be a match including Joan, Jon, or John as well as Jane or Joanna. To restrict the matches to just those names with characters between *J* and *n* and to prevent matches with names that have trailing characters, you need to enter the following formula in the cell:

```
="J*n"
```

When you use a selection formula like this, Excel matches names such as Joan, Jon, and John but not names such as Jane or Joanna that have a character after the *n*.

When setting up selection criteria, you can also use the other comparative operators, including >, >=, <, <=, and <>, in the selection criteria. See Table 2-1 for descriptions and examples of usage in selection criteria for each of these logical operators.

TABLE 2-1 The Comparative Operators in the Selection Criteria

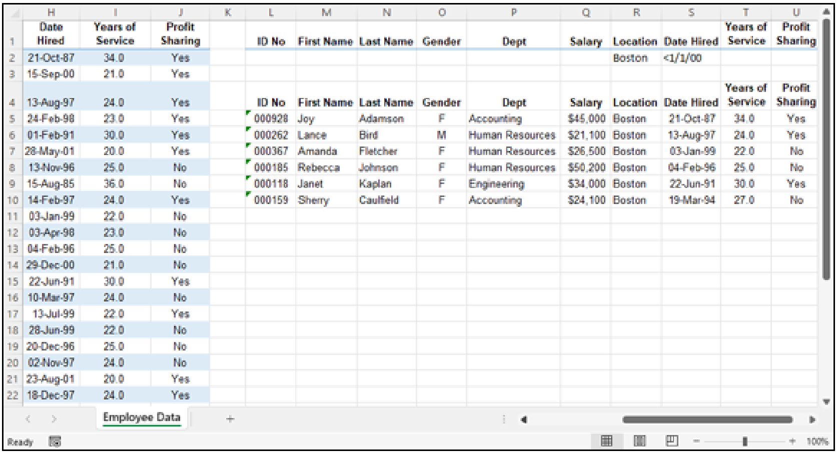
Operator	**Meaning**	**Example**	**Locates**
=	Equal to	="CA"	Records where the state is *CA*
>	Greater than	>M	Records where the name starts with a letter after *M* (that is, N through Z)
>=	Greater than or equal to	>=3/4/02	Records where the date is on or after or equal to *March 4, 2002*
<	Less than	<D	Records where the name begins with a letter before *D* (that is, A, B, or *C*)
<=	Less than or equal to	<=12/12/04	Records where the date is on or before or equal to *December 12, 2004*
<>	Not equal to	<>"CA"	Records where the state is not equal to *CA*

TIP To find all the records where a particular field is blank in the database, enter = and press the spacebar to enter a space in the cell beneath the appropriate field name. To find all the records where a particular field is *not* blank in the database, enter <> and press the spacebar to enter a space in the cell beneath the appropriate field name.

Setting up logical AND logical OR conditions

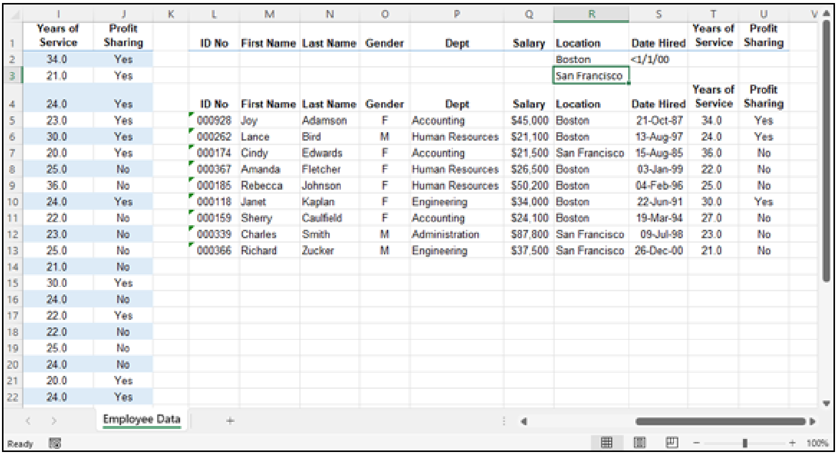
When you enter two or more criteria in the same row beneath different field names in the Criteria Range, Excel treats the criteria as a logical AND condition and selects only those records that meet both criteria. Figure 2-5 (sample workbook: Employee Table with Criteria Range.xlsx) shows an example of the results of a query that uses an AND condition. Here, Excel has copied only those records where the location is Boston *and* the date hired is before January 1, 2000, because both the criteria Boston and <1/1/00 are placed in the same row (row 2) under their respective field names, Location and Date Hired.

When you enter two or more criteria in different rows of the Criteria Range, Excel treats the criteria as a logical OR and selects records that meet any one of the criteria they contain. Figure 2-6 (sample workbook: Employee Table with Criteria Range.xlsx) shows you an example of the results of a query using an OR condition. In this example, Excel has copied records where the location is either Boston or San Francisco because Boston is entered under the Location field name in the second row (row 2) of the Criteria Range above San Francisco entered in the third row (row 3).



	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	Date Hired	Years of Service	Profit Sharing		ID No	First Name	Last Name	Gender	Dept	Salary	Location	Date Hired	Years of Service	Profit Sharing
2	21-Oct-87	34.0	Yes								Boston	<1/1/00		
3	15-Sep-00	21.0	Yes											
4	13-Aug-97	24.0	Yes		ID No	First Name	Last Name	Gender	Dept	Salary	Location	Date Hired	Years of Service	Profit Sharing
5	24-Feb-98	23.0	Yes		000928	Joy	Adamson	F	Accounting	$45,000	Boston	21-Oct-87	34.0	Yes
6	01-Feb-91	30.0	Yes		000262	Lance	Bird	M	Human Resources	$21,100	Boston	13-Aug-97	24.0	Yes
7	28-May-01	20.0	Yes		000367	Amanda	Fletcher	F	Human Resources	$26,500	Boston	03-Jan-99	22.0	No
8	13-Nov-96	25.0	No		000185	Rebecca	Johnson	F	Human Resources	$50,200	Boston	04-Feb-96	25.0	No
9	15-Aug-85	36.0	No		000118	Janet	Kaplan	F	Engineering	$34,000	Boston	22-Jun-91	30.0	Yes
10	14-Feb-97	24.0	Yes		000159	Sherry	Caulfield	F	Accounting	$24,100	Boston	19-Mar-94	27.0	No
11	03-Jan-99	22.0	No											
12	03-Apr-98	23.0	No											
13	04-Feb-96	25.0	No											
14	29-Dec-00	21.0	No											
15	22-Jun-91	30.0	Yes											
16	10-Mar-97	24.0	No											
17	13-Jul-99	22.0	Yes											
18	28-Jun-99	22.0	No											
19	20-Dec-96	25.0	No											
20	02-Nov-97	24.0	No											
21	23-Aug-01	20.0	Yes											
22	18-Dec-97	24.0	Yes											

FIGURE 2-5: Copied records where the location is Boston and the date hired is prior to January 1, 2000. (Sample workbook: Employee Table with Criteria Range.xlsx)



	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	Years of Service	Profit Sharing		ID No	First Name	Last Name	Gender	Dept	Salary	Location	Date Hired	Years of Service	Profit Sharing
2	34.0	Yes								Boston	<1/1/00		
3	21.0	Yes								San Francisco			
4	24.0	Yes		ID No	First Name	Last Name	Gender	Dept	Salary	Location	Date Hired	Years of Service	Profit Sharing
5	23.0	Yes		000928	Joy	Adamson	F	Accounting	$45,000	Boston	21-Oct-87	34.0	Yes
6	30.0	Yes		000262	Lance	Bird	M	Human Resources	$21,100	Boston	13-Aug-97	24.0	Yes
7	20.0	Yes		000174	Cindy	Edwards	F	Accounting	$21,500	San Francisco	15-Aug-85	36.0	No
8	25.0	No		000367	Amanda	Fletcher	F	Human Resources	$26,500	Boston	03-Jan-99	22.0	No
9	36.0	No		000185	Rebecca	Johnson	F	Human Resources	$50,200	Boston	04-Feb-96	25.0	No
10	24.0	Yes		000118	Janet	Kaplan	F	Engineering	$34,000	Boston	22-Jun-91	30.0	Yes
11	22.0	No		000159	Sherry	Caulfield	F	Accounting	$24,100	Boston	19-Mar-94	27.0	No
12	23.0	No		000339	Charles	Smith	M	Administration	$87,800	San Francisco	09-Jul-98	23.0	No
13	25.0	No		000366	Richard	Zucker	M	Engineering	$37,500	San Francisco	26-Dec-00	21.0	No
14	21.0	No											
15	30.0	Yes											
16	24.0	No											
17	22.0	Yes											
18	22.0	No											
19	25.0	No											
20	24.0	No											
21	20.0	Yes											
22	24.0	Yes											

FIGURE 2-6: Copied records where the location is Boston and the date hired prior to January 1, 2000 or the location is San Francisco location for any date hired. (Sample workbook: Employee Table with Criteria Range.xlsx)

When creating OR conditions, you need to remember to redefine the Criteria Range to include all the rows that contain criteria, which in this case is the cell range L2:U3. (If you forget, Excel uses only the criteria in the rows included in the Criteria range.)

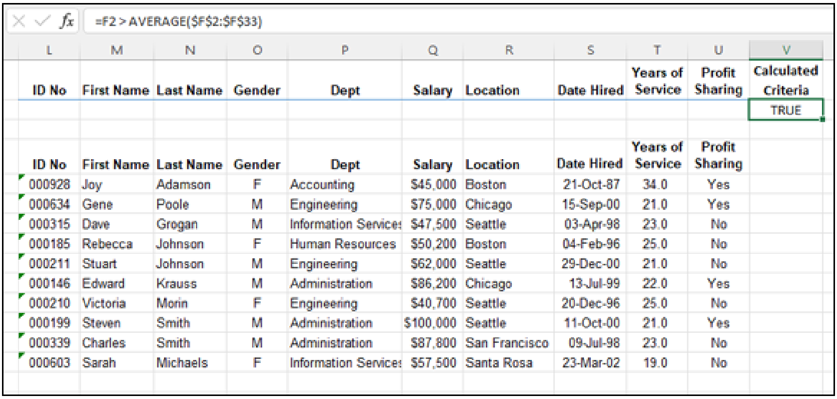
When setting up your criteria, you can combine logical AND and logical OR conditions (again, assuming you expand the Criteria Range sufficiently to include all the rows containing criteria). For example, if you enter **Boston** in cell R2 (under Location) and **<1/1/00** in cell S2 (under Date Hired) in row 2 and enter **San Francisco** in cell R3 and then repeat the query, Excel copies the records where the location is Boston and the date hired is before January 1, 2000, as well as the records where the location is San Francisco (regardless of the date hired).

Setting up calculated criteria

You can use calculated criteria when filtering or querying your table. All you need to do is enter a logical formula that Excel can evaluate as either TRUE or FALSE in the Criteria Range under a made-up name that is *not* any field name used in the table (I repeat, is *not* a field name in the table). Calculated criteria enable you to filter or query records based on a comparison of entries in a particular field with entries in other fields of the table or based on a comparison with entries in the worksheet that lie outside the table itself.

Figure 2-7 (sample workbook: Employee Table with Calculated Criteria.xlsx) shows an example of using a calculated criterion that compares values in a field to a calculated value that isn't actually entered in the table. Here, you want to perform a query that copies all the records from the Employee table where the employee's salary is above the average salary. In this figure, cell V2 contains the formula that uses the AVERAGE function to compute average employee salary and then compares the first salary entry in cell F2 of the table to that average with the following formula:

```
=F2 > AVERAGE($F$2:$F$33)
```



=F2 > AVERAGE($F$2:$F$33)

L	M	N	O	P	Q	R	S	T	U	V
ID No	First Name	Last Name	Gender	Dept	Salary	Location	Date Hired	Years of Service	Profit Sharing	Calculated Criteria
										TRUE
ID No	First Name	Last Name	Gender	Dept	Salary	Location	Date Hired	Years of Service	Profit Sharing	
000928	Joy	Adamson	F	Accounting	$45,000	Boston	21-Oct-87	34.0	Yes	
000634	Gene	Poole	M	Engineering	$75,000	Chicago	15-Sep-00	21.0	Yes	
000315	Dave	Grogan	M	Information Service:	$47,500	Seattle	03-Apr-98	23.0	No	
000185	Rebecca	Johnson	F	Human Resources	$50,200	Boston	04-Feb-96	25.0	No	
000211	Stuart	Johnson	M	Engineering	$62,000	Seattle	29-Dec-00	21.0	No	
000146	Edward	Krauss	M	Administration	$86,200	Chicago	13-Jul-99	22.0	Yes	
000210	Victoria	Morin	F	Engineering	$40,700	Seattle	20-Dec-96	25.0	No	
000199	Steven	Smith	M	Administration	$100,000	Seattle	11-Oct-00	21.0	Yes	
000339	Charles	Smith	M	Administration	$87,800	San Francisco	09-Jul-98	23.0	No	
000603	Sarah	Michaels	F	Information Service:	$57,500	Santa Rosa	23-Mar-02	19.0	No	

FIGURE 2-7: Copied records extracted from the table for employees whose salaries are above the salary average. (Sample workbook: Employee Table with Calculated Crtieria.xlsx)

Note that this logical formula is placed under the label Calculated Criteria in cell V2, which has been added to the end of the criteria range. Cell F2 is the first cell in the table that contains a salary entry. The cell range, $F$2:$F$33, used as the argument of the AVERAGE function, is the range in the Salary field that contains all the salary entries.

To use this calculated criterion, you must remember to place the logical formula under a name that isn't used as a field name in the table itself. (In this example, the label Calculated Criteria does not appear anywhere in the row of field names.) You must include this label and formula in the Criteria Range. (For this query example, the criteria range is defined as the range L2:V2.)

When you then perform the query by using the Advanced Filter feature, Excel applies this calculated criterion to every record in the database. Excel does this by adjusting the first Salary field cell reference F2 (entered as a relative reference) as the program examines the rest of the records below. Note, however, that the range reference specified as the argument of the AVERAGE function is entered as an absolute reference ($F$2:$F$33) in the criterion formula so that Excel won't adjust this reference but compare the Salary entry for each record to AVERAGE computed for this entire range (which just happens to be 40,161).

REMEMBER When entering formulas for calculated criteria that compare values outside the table to values in a particular field, you should always reference the cell containing the very first entry for that field to ensure that Excel applies your criteria to every record in the table.

You can also set up calculated criteria that compare entries in one or more fields to other entries in the table. For example, to extract the records where the Years of Service entry is at least two years greater than the record above it (assuming you have sorted the table in ascending order by years of service), you would enter the following logical formula under the cell labeled Calculated Criteria:

```
=I3 > I2 + 2
```

Most often, when referencing cells within the table itself, you want to leave the cell references relative so that they can be adjusted, because each record is examined, and the references to the cells outside the database are absolute so that these won't be changed when making the comparison with the rest of the records.

When you enter the logical formula for a calculated criterion, Excel returns the logical value TRUE or FALSE. This logical value applies to the field entry for the first record in the table that you refer to in the logical formula. By inspecting this field entry in the database and seeing whether it does indeed meet your intended selection criteria, you can usually tell whether your logical formula is correct.

Using the AND, OR, and NOT functions in calculated criteria

You can also use Excel's AND, OR, and NOT functions with the logical operators in calculated criteria to find records that fall within a range. For example, to find all the records in the employee database where the salaries range between $55,000 and $75,000, you would enter the following logical formula with the AND function under the cell with the label Calculated Criteria:

```
=AND(F2 >= 55000, F2 <= 75000)
```

To find all the records in the Employee table where the salary is either below $29,000 or above $45,000, you would enter the following logical formula with the OR function under the cell with the label Calculated Criteria:

```
=OR(F2 < 29000, F2 > 45000)
```

Using the Database Functions

Excel includes several so-called *database* functions that you can use to calculate statistics, such as the total, average, maximum, minimum, and count in a particular field of the table only when the criteria that you specify are met. For example, you could use the DSUM function in the sample Employee table to compute the sum of all the salaries for employees who were hired after January 1, 2000, or you could use the DCOUNT function to compute the number of records in the table for the Human Resources department.

The database functions, regardless of the difference in names (they all begin with the letter *D*) and the computations that they perform, all take the same three arguments as illustrated by the DAVERAGE function:

`DAVERAGE(`*`database, field, criteria`*`)`

The arguments for the database functions require the following information:

- *database* is the argument that specifies the range containing the table, and it must include the row of field names in the top row.
- *field* is the argument that specifies the table column from which the values are to be calculated by the database function (averaged in the case of the DAVERAGE function). You can specify this argument by enclosing the name of the field in double quotes (as in “Salary” or “Date Hired”), or you can do this by entering the number of the column in the table (counting from left to right with the first field counted as 1).
- *criteria* is the argument that specifies the address of the range that contains the criteria that you’re using to determine which values

are calculated. This range must include at least one field name that indicates the field whose values are to be evaluated and one cell with the values or expression to be used as the criteria.

Note that in specifying the *field* argument, you must refer to a column in the table that contains numeric or date data for all the database functions with the exception of DGET. All the rest of the database functions can't perform computations on text fields. If you mistakenly specify a column with text entries as the field argument for these database functions, Excel returns an error value or 0 as the result. Table 2-2 lists the various database functions available in Excel along with an explanation of what each one calculates. (You already know what arguments each one takes.)

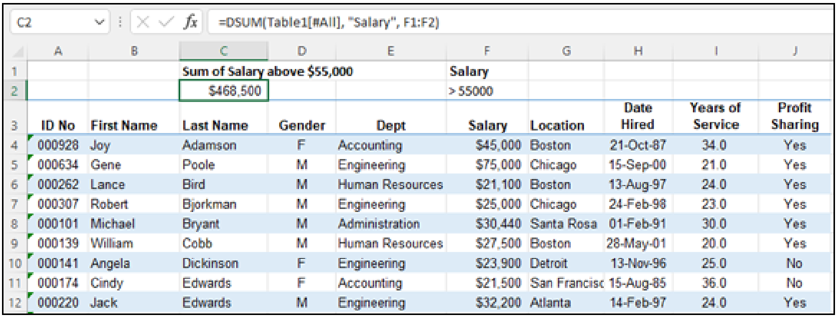
TABLE 2-2 The Database Functions in Excel

Database Function	What It Calculates
DAVERAGE	Averages all the values in a field of the table that match the criteria you specify.
DCOUNT	Counts the number of cells with numeric entries in a field of the table that match the criteria you specify.
DCOUNTA	Counts the number of nonblank cells in a field of the table that match the criteria you specify.
DGET	Extracts a single value from a record in the table that matches the criteria you specify. If no record matches, the function returns the #VALUE! error value. If multiple records match, the function returns the #NUM! error value.
DMAX	Returns the highest value in a field of the table that matches the criteria you specify.
DMIN	Returns the lowest value in a field of the table that matches the criteria you specify.
DPRODUCT	Multiplies all the values in a field of the table that match the criteria you specify.
DSTDEV	Estimates the standard deviation based on the sample of values in a field of the table that match the criteria you specify.
DSTDEVP	Calculates the standard deviation based on the population of values in a field of the table that match the criteria you specify.
DSUM	Sums all the values in a field of the table that match the criteria you specify.
DVAR	Estimates the variance based on the sample of values in a field of the table that match the criteria you specify.
DVARP	Calculates the variance based on the population of values in a field of the table that match the criteria you specify.

REMEMBER The database functions are too rarely used to rate their own command button on the Ribbon's Formulas tab. As a result, to use them in a worksheet, you must click the Insert Function (*fx*) button on the Formula bar, select Database from the Select a Category drop-down list box, and then click the function. You can also type the database function directly into the cell.

Figure 2-8 (sample workbook: Employee Table with Database Function.xlsx) illustrates the use of the database function DSUM. Cell C2 in the worksheet shown in this figure contains the following formula:

```
=DSUM(Table1[#All], "Salary", F1:F2)
```



C2

=DSUM(Table1[#All], "Salary", F1:F2)

	A	B	C	D	E	F	G	H	I	J
1			**Sum of Salary above $55,000**			**Salary**				
2			$468,500			> 55000				
3	**ID No**	**First Name**	**Last Name**	**Gender**	**Dept**	**Salary**	**Location**	**Date Hired**	**Years of Service**	**Profit Sharing**
4	000928	Joy	Adamson	F	Accounting	$45,000	Boston	21-Oct-87	34.0	Yes
5	000634	Gene	Poole	M	Engineering	$75,000	Chicago	15-Sep-00	21.0	Yes
6	000262	Lance	Bird	M	Human Resources	$21,100	Boston	13-Aug-97	24.0	Yes
7	000307	Robert	Bjorkman	M	Engineering	$25,000	Chicago	24-Feb-98	23.0	Yes
8	000101	Michael	Bryant	M	Administration	$30,440	Santa Rosa	01-Feb-91	30.0	Yes
9	000139	William	Cobb	M	Human Resources	$27,500	Boston	28-May-01	20.0	Yes
10	000141	Angela	Dickinson	F	Engineering	$23,900	Detroit	13-Nov-96	25.0	No
11	000174	Cindy	Edwards	F	Accounting	$21,500	San Francisc	15-Aug-85	36.0	No
12	000220	Jack	Edwards	M	Engineering	$32,200	Atlanta	14-Feb-97	24.0	Yes

FIGURE 2-8: Using DSUM to total the salaries over $55,000 in the Employee table. (Sample workbook: Employee Table with Database Function.xlsx)

This DSUM function computes the total of all the salaries in the table that are above $55,000. This total is $468,500, as shown in cell C2, which contains the formula.

To perform this calculation, I specified the range A3:J35, which contains the entire table. This range includes the top row of field names as the *database* argument (which Excel automatically converted to its range name equivalent, Table1[#All]). I then specified "Salary" as the field argument of the DSUM function because this field name contains the values that I want totaled. Finally, I specified the range F1:F2 as the *criteria* argument of the DSUM function because these two cells contain the criteria range that designate that only the values exceeding 55000 in the Salary field are to be summed.

Querying External Data

Excel enables you to query tables stored in external databases to which you have access and then extract the data that interests you into your worksheet for further manipulation and analysis. These data sources can include Microsoft Access database files, web pages, text files, and other data sources, such as database tables on SQL Server or Oracle, XML data files, and data tables from online connections such as Azure

Table Storage.

When importing data from such external sources into your Excel worksheets, you may well be dealing with data stored in multiple related tables all stored in the database (what Excel refers to as a *data model*). The relationship between different tables in the same database is based on a common field (column) that occurs in each related data table, which is officially known as a *key field,* but in Excel is generally known as a *lookup column.* When relating tables on a common key field, in at least one table, the records for that field must all be unique with no duplicates, such as a Clients table where each item in the Customer ID field is unique (where it's known as the *primary key*). In the other related table, the common field (known as the *foreign key*) may or may not be unique as in an Orders data table where a particular entry in its Customer ID field can appear multiple times, as it's quite permissible (even desirable) to have the same client making multiple purchases.

There's only one other thing to keep in mind when working with related data tables and that is the type of relationship that exists between the two tables. Two types of relationships are supported in a data model:

- **One-to-one relationship** where the entries in both the primary and foreign key fields are unique such as a relationship between a Clients table and Discount table where the Customer ID field occurs only once in each table (as each client has only one discount percentage assigned).
- **One-to-many relationship** where duplicate entries in the foreign key field are allowed, as in a relationship between a Clients table and an Orders table where the Customer ID field may occur multiple times (as the client makes multiple purchases).

TIP Most of the time, Excel can figure out the relationship between the data tables you import. However, if Excel should ever get it wrong or your tables contain more than one common field that could possibly serve as the key, you can manually define the proper relationship. In the Data tab's Data Tools group, select the Relationships button (or press Alt+AA) to open the Manage Relationships dialog box. Click New to open the Create Relationship dialog box, where you define the common field in each of the two related data tables. After creating this relationship, you can use any of the fields in either of the two related tables in reports that you prepare or PivotTables that you create. (See Book 7, Chapter 2 for details on creating and using PivotTables.)

To import data from external database files and tables, you select the Data tab's Get Data drop-down button in the Get & Transform Data group (or press Alt+APN). Excel displays a menu with the following choices:

- **From File:** Enables you to import data from a file saved on a local or network drive in various file formats, including Excel workbook, text or CSV (Comma Delimited Value), XML (Extensible Markup Language), and JSON (JavaScript Object Notation) file formats.
- **From Database:** Enables you to import data from tables in a specific type of database file, including SQL Server Database, Microsoft Access, Analysis Services, and SQL Analysis Server Database.
- **From Azure:** Enables you to import data from an Azure SQL database or one of the various storage spaces available on this Microsoft cloud service (visit `https://azure.microsoft.com` for more information).
- **From Power BI dataset:** Enables you to launch Power BI (Business Intelligence), a Microsoft visual data analytics program, and import data into Excel from the Power BI Data Catalog (see `https://powerbi.microsoft.com` for more information).
- **From Online Services:** Enables you to import data saved on an online service to which you already subscribe, such as Microsoft Exchange Online, Dynamics 365, or Salesforce.
- **From Other Sources:** Enables you to import data from a variety of sources, including From Sheet (a range or table in the existing workbook) or From Web (tables on a web page) or using existing queries from Microsoft Query, OData Feed, ODBC (Open Database Connectivity), OLEDB (Object Linking and Embedded Database), and Blank Query to create a new query with Excel's Power Query Editor add-in.
- **Combine Queries:** Enables you to merge two existing data tables in the current workbook or append one data table to another.
- **Launch Power Query Editor:** Opens Excel's Query Editor add-in that enables you to create advanced data queries that connect

various data sources and perform complex analysis.

- **Data Source Settings:** Opens the Data Source Settings dialog box where you can manage permissions for the external data sources that Excel can use in data queries.
- **Query Options:** Opens the Query Options dialog box where you manage the global and current workbook load and privacy settings.

Retrieving data from Access database tables

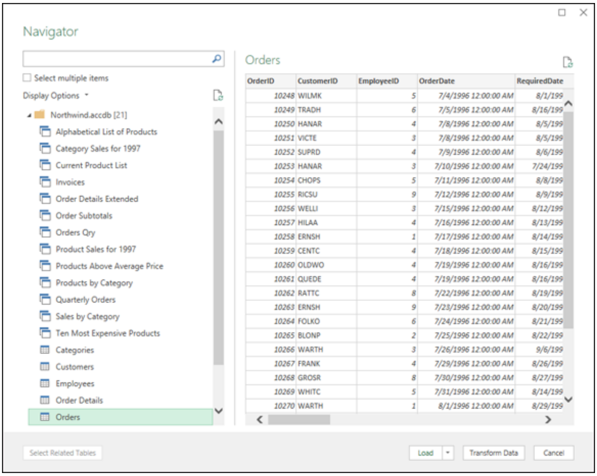
To make an external data query to a Microsoft Access database table, choose Data⇒ Get Data⇒ From Database⇒ From Microsoft Access Database (or press Alt+APNDC). Excel opens the Import Data dialog box, where you select the name of the Access database (using the `.accdb` or `.mdb` file extension) and then click the Import button.

After Excel establishes a connection with the Access database file, the Navigator dialog box opens, similar to the one shown in Figure 2-9 (sample file: Northwind.accdb). The Navigator dialog box is divided into two panes: Selection on the left and Preview on the right. When you click the name of a data table or query in the Selection Pane, Excel displays a portion of the Access data in the Preview pane on the right. To import multiple (related) data tables from the selected Access database, select the Select Multiple Items check box. Excel then displays check boxes before the name of each table in the database. After you select the check boxes for all the tables you want to import, you have a choice of options:

- **Load:** Imports the Access file data from the item(s) selected in the Navigator directly into the current worksheet starting at the cell cursor's current position.
- **Load⇒ Load To:** Opens the Import Data dialog box where you can specify how you want to view the imported Access data (as a worksheet table, a PivotTable, a PivotChart, or as a data connection without importing any data) and where to import the Access data (existing or new worksheet) as well as whether to add the Access data to the worksheet’s data model.
- **Transform Data:** Displays the Access data table(s) in the Excel Power Query Editor where you can further query and transform the data before importing into the current Excel worksheet with its Close & Load or Close & Load To option.

When you select the Load To option to specify how and where to import the Access data, the Import Data dialog box contains the following options:

- **Table:** Imports the Access data into an Excel table in either the current or new worksheet — see the “Existing Worksheet” and “New Worksheet” bullets that follow. Note that when you import more than one data table, the Existing Worksheet option is no longer available, and the data from each imported data table is imported to a separate new worksheet in the current workbook.
- **PivotTable Report:** Imports the Access data into a new PivotTable (see Book 7, Chapter 2) that you can construct with the Access data.


Navigator
☐ Select multiple items
Display Options
Northwind.accdb [21]
Alphabetical List of Products
Category Sales for 1997
Current Product List
Invoices
Order Details Extended
Order Subtotals
Orders Qry
Product Sales for 1997
Products Above Average Price
Products by Category
Quarterly Orders
Sales by Category
Ten Most Expensive Products
Categories
Customers
Employees
Order Details
Orders
Select Related Tables
Load
Transform Data
Cancel

Orders

OrderID	CustomerID	EmployeeID	OrderDate	RequiredDate
10248	WILMK	5	7/4/1996 12:00:00 AM	8/1/199
10249	TRADH	6	7/5/1996 12:00:00 AM	8/16/199
10250	HANAR	4	7/8/1996 12:00:00 AM	8/5/199
10251	VICTE	3	7/8/1996 12:00:00 AM	8/5/199
10252	SUPRD	4	7/9/1996 12:00:00 AM	8/6/199
10253	HANAR	3	7/10/1996 12:00:00 AM	7/24/199
10254	CHOPS	5	7/11/1996 12:00:00 AM	8/8/199
10255	RICSU	9	7/12/1996 12:00:00 AM	8/9/199
10256	WELLI	3	7/15/1996 12:00:00 AM	8/12/199
10257	HILAA	4	7/16/1996 12:00:00 AM	8/13/199
10258	ERNSH	1	7/17/1996 12:00:00 AM	8/14/199
10259	CENTC	4	7/18/1996 12:00:00 AM	8/15/199
10260	OLDWO	4	7/19/1996 12:00:00 AM	8/16/199
10261	QUEDE	4	7/19/1996 12:00:00 AM	8/16/199
10262	RATTC	8	7/22/1996 12:00:00 AM	8/19/199
10263	ERNSH	9	7/23/1996 12:00:00 AM	8/20/199
10264	FOLKO	6	7/24/1996 12:00:00 AM	8/21/199
10265	BLONP	2	7/25/1996 12:00:00 AM	8/22/199
10266	WARTH	3	7/26/1996 12:00:00 AM	9/6/199
10267	FRANK	4	7/29/1996 12:00:00 AM	8/26/199
10268	GROSR	8	7/30/1996 12:00:00 AM	8/27/199
10269	WHITC	5	7/31/1996 12:00:00 AM	8/14/199
10270	WARTH	1	8/1/1996 12:00:00 AM	8/29/199

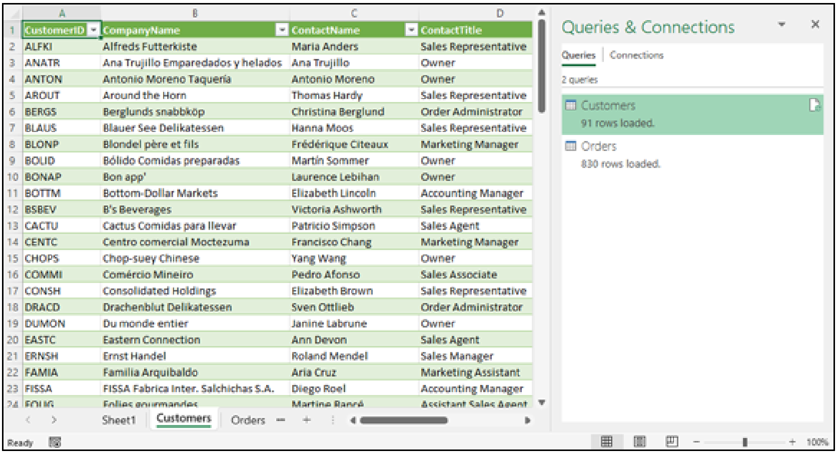
FIGURE 2-9: Using the Navigator to select which data tables and queries from the Northwind Access database to import into the current Excel worksheet. (Sample file: Northwind.accdb)

- **PivotChart:** Imports the Access data into a new PivotTable (see Book 7, Chapter 2) with an embedded PivotChart that you can construct with the Access data.
- **Only Create Connection:** Creates a connection to the Access database table(s) that you can use later to import its data.
- **Existing Worksheet:** Imports the Access data into the current worksheet starting at the current cell address listed in the text box below.
- **New Worksheet:** Imports the Access data into a new sheet that’s added to the end of the sheets already in the workbook.
- **Add This Data to the Data Model:** Adds the Access data to the

data model already defined in the Excel workbook using relatable, key fields.

- **Properties:** Opens the drop-down menu with the Import Relationships Between Tables check box (selected by default) and Properties item. Deselect the check box to prevent Excel from recognizing the relationship established between the data tables in Access. Click the Properties button to open the Connection Properties dialog box, where you can modify all sorts of connection properties, including when the Access data's refreshed in the Excel worksheet and how the connection is made.

Figure 2-10 (sample file: Northwind.accdb) shows you a workbook after importing both the Customers and Orders tables from the sample Northwind Access database as new tables on separate worksheets. When I imported the two data tables, Excel automatically added two new worksheets (named Customers and Orders) to the workbook, while at the same time importing the Customers data table to the Customers sheet and the Orders data table to the Orders sheet.



	A	B	C	D
1	CustomerID	CompanyName	ContactName	ContactTitle
2	ALFKI	Alfreds Futterkiste	Maria Anders	Sales Representative
3	ANATR	Ana Trujillo Emparedados y helados	Ana Trujillo	Owner
4	ANTON	Antonio Moreno Taquería	Antonio Moreno	Owner
5	AROUT	Around the Horn	Thomas Hardy	Sales Representative
6	BERGS	Berglunds snabbköp	Christina Berglund	Order Administrator
7	BLAUS	Blauer See Delikatessen	Hanna Moos	Sales Representative
8	BLONP	Blondel père et fils	Frédérique Citeaux	Marketing Manager
9	BOLID	Bólido Comidas preparadas	Martín Sommer	Owner
10	BONAP	Bon app'	Laurence Lebihan	Owner
11	BOTTM	Bottom-Dollar Markets	Elizabeth Lincoln	Accounting Manager
12	BSBEV	B's Beverages	Victoria Ashworth	Sales Representative
13	CACTU	Cactus Comidas para llevar	Patricio Simpson	Sales Agent
14	CENTC	Centro comercial Moctezuma	Francisco Chang	Marketing Manager
15	CHOPS	Chop-suey Chinese	Yang Wang	Owner
16	COMMI	Comércio Mineiro	Pedro Afonso	Sales Associate
17	CONSH	Consolidated Holdings	Elizabeth Brown	Sales Representative
18	DRACD	Drachenblut Delikatessen	Sven Ottlieb	Order Administrator
19	DUMON	Du monde entier	Janine Labrune	Owner
20	EASTC	Eastern Connection	Ann Devon	Sales Agent
21	ERNSH	Ernst Handel	Roland Mendel	Sales Manager
22	FAMIA	Familia Arquibaldo	Aria Cruz	Marketing Assistant
23	FISSA	FISSA Fabrica Inter. Salchichas S.A.	Diego Roel	Accounting Manager
24	FOLIG	Folies gourmandes	Martine Rancé	Assistant Sales Agent

Customers
91 rows loaded.

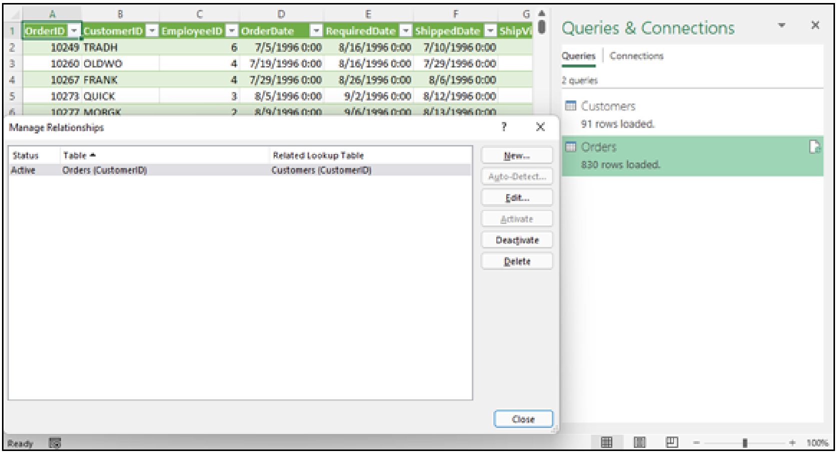
Orders
830 rows loaded.

FIGURE 2-10: Customers worksheet with the data imported from the Access Customers data table in the sample Northwind database. (Sample file: Northwind.accdb)

Figure 2-11 (sample file: Northwind.accdb) shows the same new workbook, this time with the Orders worksheet selected and the Manage Relationships dialog box open (by clicking the Data tab's Relationships button or pressing Alt+AA). When Excel imported these two data tables, it automatically picked up on and retained the original relationship between them in the Northwind database, where the CustomerID field is the primary key field in the Customers data table and a foreign key field in the Orders data table.

After importing the external data into one of your Excel worksheets, you can then use the Filter buttons attached to the various fields to sort the data (as described in Book 6, Chapter 1) and filter the data (as described earlier in this chapter).

REMEMBER After you import data from an external source, such as a Microsoft Access database, Excel automatically displays a Queries & Connections task pane with two tabs: Queries, which displays the source(s) of the data imported into the current workbook, and Connections, which displays their connection to the workbook data model (and to each other if there are multiple sources and they are related to each other). If this task pane is not currently displayed in the current worksheet, choose Data⇒ Queries & Connections (or press Alt + AO) to redisplay it.



OrderID	CustomerID	EmployeeID	OrderDate	RequiredDate	ShippedDate	ShipVi
10249	TRADH	6	7/5/1996 0:00	8/16/1996 0:00	7/10/1996 0:00	
10260	OLDWO	4	7/19/1996 0:00	8/16/1996 0:00	7/29/1996 0:00	
10267	FRANK	4	7/29/1996 0:00	8/26/1996 0:00	8/6/1996 0:00	
10273	QUICK	3	8/5/1996 0:00	9/2/1996 0:00	8/12/1996 0:00	
10277	MORGK	2	8/9/1996 0:00	9/6/1996 0:00	8/13/1996 0:00	

Manage Relationships

Status	Table	Related Lookup Table
Active	Orders (CustomerID)	Customers (CustomerID)

Queries & Connections

2 queries

Customers
91 rows loaded.

Orders
830 rows loaded.

FIGURE 2-11: Orders worksheet with the data imported from the Orders data table in the sample Northwind database showing the relationship with the Customers table. (Sample file: Northwind.accdb)

TIP Excel keeps a list of all the external data sources and data queries you make to the current workbook so that you can reuse them to import updated data from another database or web page. To quickly reconnect with a data source, click the Data tab's Recent Sources button (or press Alt+PR) to open the Recent Sources dialog box where you click the name of the external file before you select the Connect button. To reuse a query, click the Data tab's Existing Connections button (or press Alt+AX) to open the Existing Connections dialog box to access this list and then click the name of the query to repeat before you click the Open button.

Retrieving data from the web

To make a web page query, choose Data⇒ Get Data⇒ From Other Sources⇒ From Web (or press Alt+AFW). Excel then opens the From Web dialog box containing a URL text box where you specify the address of the web page containing the data you want to import into Excel as in

```
www.nasdaq.com
```

After you click OK in the From Web dialog box, Excel establishes a connection with the web page before opening the Navigator dialog box (similar to the one shown earlier in Figure 2-9). When you select a table in the list in the Selection pane on the left, Excel displays a preview of the data in the Table View tab of the Preview pane on the right (to display the data more or less as it appears on the web page itself, you click the Web View tab in this pane). To import more than one table of data from a web page, click the Select Multiple Items check box and then click the check boxes in front of the name (Table 1, Table 2, and so on) you want imported.

After you finish checking the table or tables you want to import on the page, you can select one of the following three import options:

- **Load:** Imports the web data in the tables selected in the Navigator directly into the current worksheet starting at the cell cursor’s current position.
- **Load⇒ Load To:** Opens the Import Data dialog box where you can choose how you want to view the imported web data (as a worksheet table, PivotTable, PivotChart, or just data connection

without importing any data) and where to import the web data (into an existing or new worksheet) as well as whether to add the web data to the worksheet's data model.

- **Transform Data:** Display the web data table(s) in the Excel Power Query Editor where you can further query and transform the data before importing into the current Excel worksheet with its Close & Load or Close & Load To option.

After importing your web data into a new or existing worksheet, you can then manipulate the data as you would any other worksheet table, including filtering it and sorting with the AutoFilter buttons.

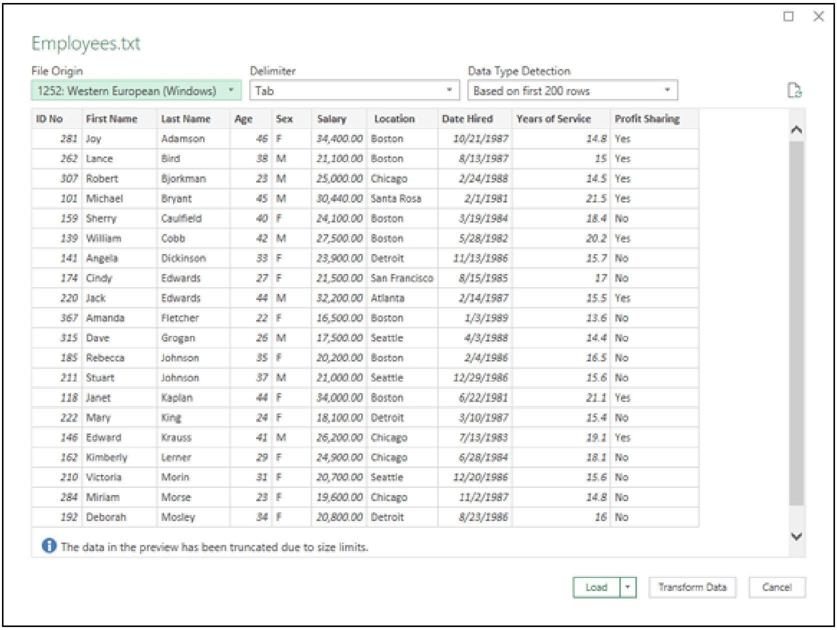
TIP When working with tables of stock quotes imported from financial websites, such as NASDAQ and MSN Money, during periods when the markets are still open and active, you can use the Data tab's Refresh All command (or press Alt+ARA) to keep the stock prices and trading volume entries in your worksheet up to date.

WARNING You can only make web queries when your computer has Internet access. So, if you're using Excel on a device that can't connect to the web at the moment, you won't be able to perform a new web query until you get to a place where you can get online.

Retrieving data from text files

If you have a text file containing data you need to bring into your worksheet, you can import it by choosing Data⇒ Get Data⇒ From File⇒ From Text/CSV (or press Alt+AFT) and then selecting the file to use in the Import Data dialog box. After you select the text file containing the data you need to retrieve in this dialog box and click its Import button, Excel opens the Navigator dialog box with the name of the text or CSV (Comma Separated Value) file as its title.

This version of the Navigator, as shown in Figure 2-12 (sample file: Employees.txt), automatically scans and analyzes the data in the text or CSV file and attempts to correctly split up (or *parse*) its data into separate cells of the worksheet based on what Excel character the program determines is the standard character used to separate each data item (such as a comma or tab) in every line, just as it uses the character for the Enter key to mark the separation of each line of data within the file.



File Origin: 1252: Western European (Windows)

Delimiter: Tab

Data Type Detection: Based on first 200 rows

ID No	First Name	Last Name	Age	Sex	Salary	Location	Date Hired	Years of Service	Profit Sharing
281	Joy	Adamson	46	F	34,400.00	Boston	10/21/1987	14.8	Yes
262	Lance	Bird	38	M	21,100.00	Boston	8/13/1987	15	Yes
307	Robert	Bjorkman	23	M	25,000.00	Chicago	2/24/1988	14.5	Yes
101	Michael	Bryant	45	M	30,440.00	Santa Rosa	2/1/1981	21.5	Yes
159	Sherry	Caulfield	40	F	24,100.00	Boston	3/19/1984	18.4	No
139	William	Cobb	42	M	27,500.00	Boston	5/28/1982	20.2	Yes
141	Angela	Dickinson	33	F	23,900.00	Detroit	11/13/1986	15.7	No
174	Cindy	Edwards	27	F	21,500.00	San Francisco	8/15/1985	17	No
220	Jack	Edwards	44	M	32,200.00	Atlanta	2/14/1987	15.5	Yes
367	Amanda	Fletcher	22	F	16,500.00	Boston	1/3/1989	13.6	No
315	Dave	Grogan	26	M	17,500.00	Seattle	4/3/1988	14.4	No
185	Rebecca	Johnson	35	F	20,200.00	Boston	2/4/1986	16.5	No
211	Stuart	Johnson	37	M	21,000.00	Seattle	12/29/1986	15.6	No
118	Janet	Kaplan	44	F	34,000.00	Boston	6/22/1981	21.1	Yes
222	Mary	King	24	F	18,100.00	Detroit	3/10/1987	15.4	No
146	Edward	Krauss	41	M	26,200.00	Chicago	7/13/1983	19.1	Yes
162	Kimberly	Lerner	29	F	24,900.00	Chicago	6/28/1984	18.1	No
210	Victoria	Morin	31	F	20,700.00	Seattle	12/20/1986	15.6	No
284	Miriam	Morse	23	F	19,600.00	Chicago	11/2/1987	14.8	No
192	Deborah	Mosley	34	F	20,800.00	Detroit	8/23/1986	16	No

The data in the preview has been truncated due to size limits.

FIGURE 2-12: Importing the data in a tab-delimited text file into a worksheet using the options in Navigator dialog box. (Sample file: Employees.txt)

REMEMBER Text files that use the comma to separate data items are known as *CSV files* (for Comma Separated Values). Those that use tabs to separate the individual data items are known as *tab delimited* files. Note that some programs use the generic term, *delimited files,* to refer to any text file that uses a standard character, such as a comma or tab, to separate its individual data items.

If Excel has correctly parsed the data in your text or CSV file as shown in the preview in the Navigator, you can then select one of the following three import options to bring the data into your worksheet:

- **Load:** Imports the parsed text data previewed in the Navigator directly into the current worksheet starting at the cell cursor's current position.
- **Load⇒ Load To:** Opens the Import Data dialog box where you can choose how you want to view the imported text data (as a worksheet table, PivotTable, PivotChart, or just data connection without importing any data) and where to import the text data (into an existing or new worksheet) as well as whether to add the text data to the worksheet's data model.
- **Transform Data:** Displays the parsed text data in the Excel Power Query Editor where you can further query and transform the data before importing into the current Excel worksheet with its Close & Load or Close & Load To option.

If Excel has not correctly parsed the data in your text or CSV file in the preview in the Navigator, you can try changing one of the three settings used in determining how the data is parsed before proceeding with any kind of import:

- **File Origin:** Select a new text file type based on its country code on the File Origin drop-down menu.
- **Delimiter:** Select a new delimiting character on the Delimiter drop-down menu to be used in parsing the data into separate cells.
- **Data Type Detection:** Change the number of rows used in trying to determine whether the parsed data is a number, date, or text value either by selecting the Based on Entire Dataset option on the Data Type Detection drop-down menu to use all the rows in the file or select Do Not Detect Data Types option to prevent Excel from trying to differentiate the data types.

If Excel still can't correctly parse your text or CSV file in the preview and insists on importing each row of text data into a single column, all is not lost. You can still go ahead with the import and then after bringing the data of the text file into a new or existing worksheet, use the Convert to Text Wizard to correctly parse it into separate columns.

To do this, select the cells with the imported text data. then click the Data tab's Text to Columns command (or press Alt+AE). Excel opens the Convert Text to Columns Wizard - Step 1 of 3 dialog box. Here, you choose between the Delimited and Fixed Width option determine how the data is to be separated before clicking the Next button to open the Convert Text to Columns Wizard - Step 2 of 3 dialog box.

In the Step 2 of 3 dialog box when you previously selected the Delimited option in the Step 1 of 3 dialog box, you need to select the delimiting character if the wizard selects the wrong character in the Delimiters section before clicking the Next button. If your text file uses a custom delimiting character, you need to select the Other check box and then enter that character in its text box. If your file uses two consecutive characters (such as a comma and a space), you need to select their check boxes as well as the Treat Consecutive Delimiters As One check box.

By default, the Convert Text to Columns Wizard treats any characters enclosed in a pair of double quotes as text entries (as opposed to numbers). If your text file uses a single quote, click the single quote (‘) character in the Text Qualifier drop-down list box.

If, instead, you selected the Fixed Width option in the Step 1 of 3 dialog box, the Step 2 of 3 dialog box previews the column breaks that indicate how the text data appears when split apart into separate columns of the worksheet. You can then modify the column breaks in the preview with your mouse. Click in the sample data shown in the Data Preview area to create new column breaks and modify the extent of the breaks by dragging their borders. When the column breaks in the data preview appear correct, click the Next button to open the Convert Text to Columns Wizard - Step 3 of 3 dialog box.

In the Step 3 of 3 dialog box, you get to assign a data type to the various columns of text data or indicate that a particular column of data should be skipped and therefore not imported into your Excel worksheet.

When setting data formats for the columns of the text file, you can choose among the following three data types:

- **General** (the default) to convert all numeric values to numbers, entries recognized as date values to dates, and everything else in the column to text
- **Text** to convert all the entries in the column to text
- **Date** to convert all the entries to dates by using the date format shown in the associated drop-down list box

To assign one of the three data types to a column, click its column in the Data Preview section and then click the appropriate radio button (General, Text, or Date) in the Column Data Format section in the upper-left corner.

In determining values when using the General data format, Excel uses the period (.) as the decimal separator and the comma (,) as the thousands separator. If you're dealing with data that uses these two symbols in just the opposite way (the comma for the decimal and the period for the thousands separator), as is the case in many European countries, click the Advanced button in the Step 3 of 3 dialog box to open the Advanced Text Import Settings dialog box. There, select the comma (,) in the Decimal Separator drop-down list box and the period (.) in the Thousands Separator drop-down list box before you click OK. If your text file uses trailing minus signs (as in 100–) to represent negative numbers (as in −100), make sure that the Trailing Minus for Negative Numbers check box contains a check mark.

If you want to change the date format for a column to which you've assigned the Date data format, click its M-D-Y code in the Date drop-down list box (where *M* stands for the month, *D* for the day, and *Y* for the year).

REMEMBER To skip the importing of a particular column, click it in the Data Preview and then select the Do Not Import Column (Skip) option button at the bottom of the Column Data Format section.

After you have all the columns formatted as you want, click the Finish button in the Convert Text to Columns – Step 3 of 3 dialog box. Excel then splits the entries in the imported text file into separate columns of the current worksheet, and all that's left for you to do is, perhaps, adjust the column widths to suit.

Querying data from other data sources

Database tables created and maintained with Microsoft Access are not, of course, the only external database sources on which you can perform external data queries. To import data from other sources, choose Data⇒ Get Data⇒ From Database (or press Alt + APND) to open a drop-down menu with other database options including:

- **From SQL Server Database** to import data from an SQL server database.
- **From Analysis Services** to import data from an SQL Server Analysis cube.

- **From SQL Server Analysis Services Database (Import)** to import data from an SQL server database using an optional MDX or DAX query.

In addition, the From Other Sources option on the Get Data drop-down menu offers you the following querying choices:

- **From Sheet** to create a new query in the Power Query Editor using the selected Excel data table or named cell range in the current worksheet (same as clicking the From Table/Range command button on the Ribbon's Data tab).
- **From Web** to import data from a web page (same as clicking the From Web command button on the Ribbon's Data tab).
- **From Microsoft Query** to import data from a database table using Microsoft Query that follows the ODBC (Open DataBase Connectivity) standards.
- **From SharePoint List** to import data from a Microsoft SharePoint website.
- **From OData Feed** to import data from any database table following the Open Data Protocol (shortened to OData) — note that you must provide the file location (usually a URL) and user ID and password to access the OData data feed before you can import any of its data into Excel.
- **From Hadoop File (HDFS)** to import data from a Hadoop Distributed File System.
- **From Active Directory** to import data from the Microsoft Active Directory service for Windows domain networks.
- **From Microsoft Exchange** to import data from a Microsoft Exchange Server.
- **From ODBC** to import data from a database that follows Microsoft's ODBC (Open Database Connectivity) standards.
- **From OLEDB** to import data from a database that follows the OLEDB (Object Linked Embedded Database) standards.
- **Blank Query** to create a brand-new database query in the Power Query Editor.

Transforming a data query in the Power Query Editor

Whenever you do a data query in Excel using the From Text/CSV, From Web, or From Sheet command buttons on the Ribbon's Data tab, you have the option of transforming that query in the Power Query Editor. When you do an external query with the From Text/CSV, or From Web options, you open the Power Query Editor after specifying the data table(s) to import into Excel by clicking Transform Data button in the Navigator dialog box. However, whenever you use the From Sheet command to designate a selected cell range in the current worksheet as a data table, Excel automatically opens the data table in a new Power Query Editor window so that you can create or transform an existing query.

Although the subject of using the Power Query Editor to perform advanced queries is well beyond the scope of this book, basic use of the Power Query Editor should prove to be no problem as the Power Query Editor's interface and essential features are very similar to those of Excel.

Figure 2-13 (sample workbook: Contoso Stores.xlsx) shows the Power Query Editor window after opening it to create a new query with the Contoso Stores table. To create the new query, I select a cell in the table before choosing Data⇒ Get Data⇒ From Sheet.

As you see in this figure, in the Power Query Editor, the imported Excel client data table retains its worksheet row and column arrangement with the column headings complete with Auto-Filter drop-down buttons intact. Above the data table, the Power Query Editor sports a Ribbon type command structure with a File menu followed by four tabs: Home, Transform, Add Column, and View. To the right of the imported data table, a Query Settings task pane appears that not only displays the source of the data (a table named Table1) but also all the steps applied in building this new query.

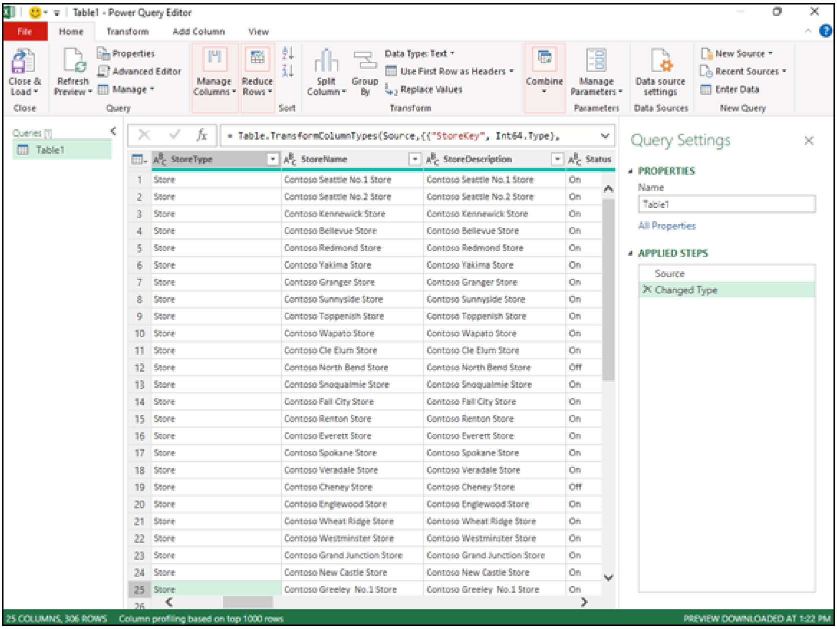


Table1 - Power Query Editor
File
Home
Transform
Add Column
View
Close & Load
Refresh Preview
Properties
Advanced Editor
Manage
Manage Columns
Reduce Rows
Split Column
Group By
Data Type: Text
Use First Row as Headers
Replace Values
Combine
Manage Parameters
Data source settings
New Source
Recent Sources
Enter Data
Close
Query
Sort
Transform
Parameters
Data Sources
New Query
Queries [1]
Table1
Query Settings
PROPERTIES
Name
All Properties
APPLIED STEPS
Source
Changed Type

```
= Table.TransformColumnTypes(Source,{{"StoreKey", Int64.Type},
```

Name: Table1

	StoreType	StoreName	StoreDescription	Status
1	Store	Contoso Seattle No.1 Store	Contoso Seattle No.1 Store	On
2	Store	Contoso Seattle No.2 Store	Contoso Seattle No.2 Store	On
3	Store	Contoso Kennewick Store	Contoso Kennewick Store	On
4	Store	Contoso Bellevue Store	Contoso Bellevue Store	On
5	Store	Contoso Redmond Store	Contoso Redmond Store	On
6	Store	Contoso Yakima Store	Contoso Yakima Store	On
7	Store	Contoso Granger Store	Contoso Granger Store	On
8	Store	Contoso Sunnyside Store	Contoso Sunnyside Store	On
9	Store	Contoso Toppenish Store	Contoso Toppenish Store	On
10	Store	Contoso Wapato Store	Contoso Wapato Store	On
11	Store	Contoso Cle Elum Store	Contoso Cle Elum Store	On
12	Store	Contoso North Bend Store	Contoso North Bend Store	Off
13	Store	Contoso Snoqualmie Store	Contoso Snoqualmie Store	On
14	Store	Contoso Fall City Store	Contoso Fall City Store	On
15	Store	Contoso Renton Store	Contoso Renton Store	On
16	Store	Contoso Everett Store	Contoso Everett Store	On
17	Store	Contoso Spokane Store	Contoso Spokane Store	On
18	Store	Contoso Veradale Store	Contoso Veradale Store	On
19	Store	Contoso Cheney Store	Contoso Cheney Store	Off
20	Store	Contoso Englewood Store	Contoso Englewood Store	On
21	Store	Contoso Wheat Ridge Store	Contoso Wheat Ridge Store	On
22	Store	Contoso Westminster Store	Contoso Westminster Store	On
23	Store	Contoso Grand Junction Store	Contoso Grand Junction Store	On
24	Store	Contoso New Castle Store	Contoso New Castle Store	On
25	Store	Contoso Greeley No.1 Store	Contoso Greeley No.1 Store	On

25 COLUMNS, 306 ROWS   Column profiling based on top 1000 rows   PREVIEW DOWNLOADED AT 1:22 PM

FIGURE 2-13: Creating a new query in the Power Query Editor using a data table created in an Excel worksheet. (Sample workbook: Contoso Stores.xlsx)

Once the Contoso Store data records are loaded into the Power Query Editor, I can use its commands to query the data before returning the subset of records to a new worksheet in Excel. For this query, I am interested in creating a subset of records where the status of the store is On and the number of employees is greater than 100. To do this, I use the AutoFilter buttons on the Status and EmployeeCount fields, as shown in Figure 2-14 (sample workbook: Contoso Stores.xlsx) to filter the records to display just those with On in the Status field and with the Greater Than number filter set to 100 for the EmployeeCount field. Then, I sort the records from the highest to lowest employee count by sorting on the EmployeeCount field in descending order. After that, I'm ready to select the Close & Load To option on the Close & Load command button on the Home tab to save my query and load it into a new worksheet in the current workbook. To do this, I accept the default settings of Table and New Worksheet in the Import Data dialog box that appears after selecting the Close & Load To option prior to clicking OK.

Figure 2-15 shows the results. Here you see the new Excel worksheet that the Editor created before it copied the filtered and sorted the subset of the Contoso Stores records into a new data table in cell range A1:Y4. When the Power Query Editor imported this new data table, the program also assigned it a table style, added AutoFilter buttons, and opened a Queries & Connections task pane. Now all that's left to do is a bit of formatting and renaming the worksheet.

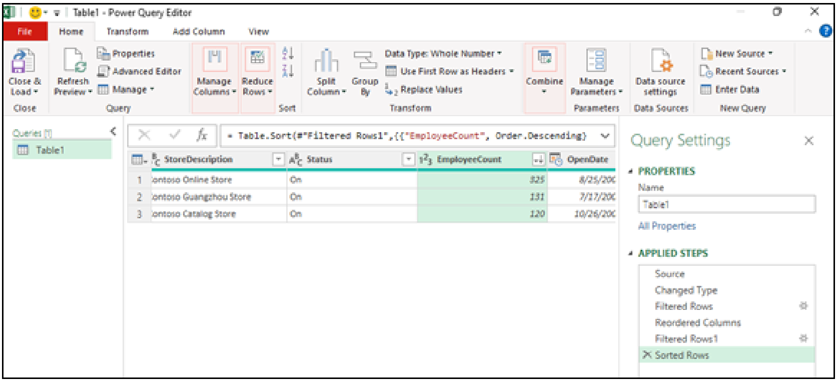


Table1 - Power Query Editor
File
Home
Transform
Add Column
View
Close & Load
Refresh Preview
Properties
Advanced Editor
Manage
Manage Columns
Reduce Rows
Split Column
Group By
Data Type: Whole Number
Use First Row as Headers
Replace Values
Combine
Manage Parameters
Data source settings
New Source
Recent Sources
Enter Data
Close
Query
Sort
Transform
Parameters
Data Sources
New Query
Queries [1]
Table1
Query Settings
PROPERTIES
All Properties
APPLIED STEPS

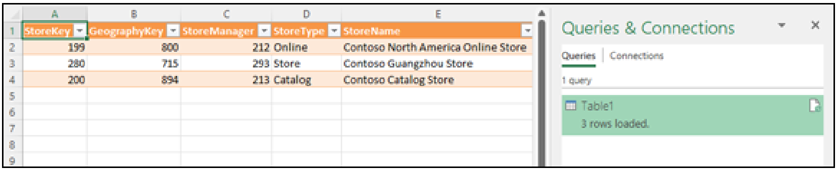
```
= Table.Sort(#"Filtered Rows1",{{"EmployeeCount", Order.Descending}
```

	StoreDescription	Status	EmployeeCount	OpenDate
1	ontoso Online Store	On	325	8/25/20C
2	ontoso Guangzhou Store	On	131	7/17/20C
3	ontoso Catalog Store	On	120	10/26/20C

Name: Table1

- Source
- Changed Type
- Filtered Rows
- Reordered Columns
- Filtered Rows1
- Sorted Rows

FIGURE 2-14: Setting the filtering and sorting criteria for the new data query in the Power Query Editor. (Sample workbook: Contoso Stores.xlsx)


Queries & Connections
Queries
Connections
1 query
Table1
3 rows loaded.

	A	B	C	D	E
1	StoreKey	GeographyKey	StoreManager	StoreType	StoreName
2	199	800	212	Online	Contoso North America Online Store
3	280	715	293	Store	Contoso Guangzhou Store
4	200	894	213	Catalog	Contoso Catalog Store
5					
6					
7					
8					
9					

FIGURE 2-15: The Contoso Stores data queried in the Power Query Editor after loading it into a new Excel worksheet.

Book 7

Data Analysis

Contents at a Glance

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Chapter 1

Performing What-If Analysis

IN THIS CHAPTER

- **Doing what-if analysis in one- and two-variable data tables**
- **Creating and playing with different scenarios**
- **Performing goal seeking**
- **Using the Solver add-in utility**

Because electronic worksheet formulas are so good at automatically updating their results based on new input, they have long been used (and, sometimes, misused) to create financial projections based on reasonable (and, sometimes, dubious) assumptions. Under the guise of what-if analysis, company number crunchers often use Excel as their crystal ball for projecting the results of promising (and, sometimes, harebrained) schemes designed to make the company more money.

As you start dabbling in this form of electronic fortune-telling, keep in mind that the projections you get back from this type of analysis are only as good as your assumptions. So, when the results of what-if analysis tell you that you're going to be richer than King Midas after undertaking this new business venture, you still need to ask yourself whether the original assumptions on which these glowing projections are based fit in with real-world marketing conditions. In other words, when the worksheet tells you that you can make a million bucks of pure profit by selling lead-lined boxer shorts, you still have to question how many men really need that kind of protection and are willing to pay for it.

In Excel, what-if analysis comes in a variety of flavors (some of which are more complicated than others). In this chapter, I introduce you to three straightforward methods:

- **Data tables** enable you to see how changing one or two variables affects the bottom line. (For example, you may want to know what happens to the net profit if you fall into a 45 percent tax bracket, a 60 percent tax bracket, and so on.)

- **Goal seeking** enables you to find out what it takes to reach a predetermined objective, such as how much you have to sell to make a $20 million profit this year.
- **Scenarios** let you set up and test a wide variety of cases, all the way from the best-case scenario (profits grow by 20 percent) to the worst-case scenario (in which you don't make any profit).

I also introduce you to Solver utility, which enables you to find solutions to more complex what-if problems involving multiple variables. You can use Solver to help you with classic resource problems, such as finding the correct product mix to maximize your profits, staffing to minimize your general costs, and routing to minimize transportation costs.

Using Data Tables

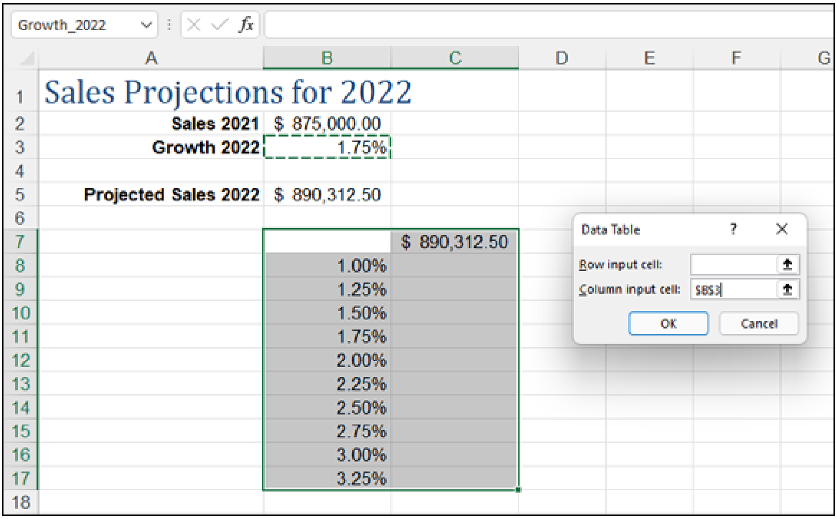
In an Excel worksheet, you can see the effect of changing an input value on the result returned by a formula as soon as you enter a new input value in a cell that feeds into the formula. Each time you change this input value, Excel automatically recalculates the formula and shows you the new result based on the new value. This method is of limited use, however, when you are performing what-if analysis and need to be able to see the range of results produced by using a series of different input values in the same worksheet so that you can compare them to each other.

To perform this type of what-if analysis, you can use Excel's Data Table command. When creating a data table, you enter a series of input values in the worksheet, and Excel uses each value in the formula that you specify. When Excel is finished computing the data table, you see the results produced by each change in the input values in a single range of the worksheet. You can then save the data table as part of the worksheet if you need to keep a record of the results of a series of input values.

When creating data tables, you can create a one-variable or a two-variable data table. In a one-variable data table, Excel substitutes a series of different values for a single input value in a formula. In a two-variable data table, Excel substitutes a series of different values for two input values in a formula.

Creating a one-variable data table

To create a one-variable data table, you need to set up the master formula in your worksheet and then, in a different range of the worksheet, enter the series of different values that you want substituted for a single input value in that formula. Figures 1-1 and 1-2 (sample workbook: Data Table 1 - Projected Sales.xlsx for both) demonstrate how this is done.



	A	B	C
1	Sales Projections for 2022		
2	**Sales 2021**	$ 875,000.00	
3	**Growth 2022**	1.75%	
4			
5	**Projected Sales 2022**	$ 890,312.50	
6			
7			$ 890,312.50
8		1.00%	
9		1.25%	
10		1.50%	
11		1.75%	
12		2.00%	
13		2.25%	
14		2.50%	
15		2.75%	
16		3.00%	
17		3.25%	
18			

Row input cell:

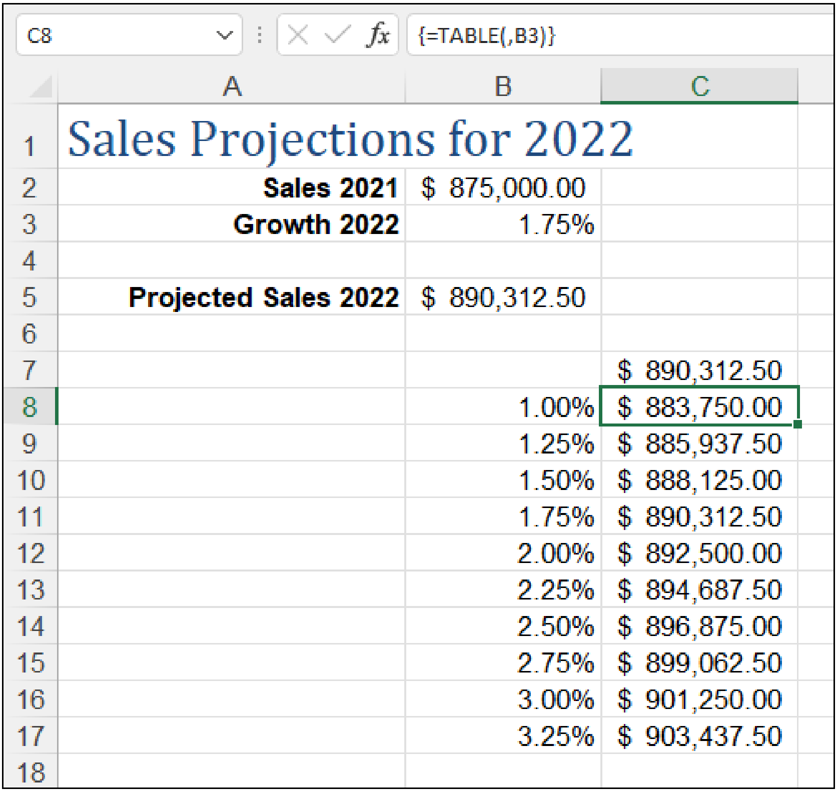
Column input cell: $B$3

FIGURE 1-1: Creating a one-variable data table. (Sample workbook: Data Table 1 - Projected Sales.xlsx)

In Figure 1-1, cell B5 contains a formula for computing the projected sales for 2022, assuming an annual growth rate of 1.75% over the annual sales in 2021. The 2022 projected sales in this cell are calculated with the following formula:

```
=Sales_2021 + (Sales_2021 * Growth_2022)
```

This formula adds cell B2 (named Sales_2021) to the contents of B2 multiplied by the growth rate of 1.75% in cell B3 (named Growth_2022). Cell B5 shows you that, assuming an annual growth rate of 1.75% in 2022, you can project total sales of $890,312.50.



	A	B	C
1	Sales Projections for 2022		
2	**Sales 2021**	$ 875,000.00	
3	**Growth 2022**	1.75%	
4			
5	**Projected Sales 2022**	$ 890,312.50	
6			
7			$ 890,312.50
8		1.00%	$ 883,750.00
9		1.25%	$ 885,937.50
10		1.50%	$ 888,125.00
11		1.75%	$ 890,312.50
12		2.00%	$ 892,500.00
13		2.25%	$ 894,687.50
14		2.50%	$ 896,875.00
15		2.75%	$ 899,062.50
16		3.00%	$ 901,250.00
17		3.25%	$ 903,437.50
18			

FIGURE 1-2: The completed one-variable data table. (Sample workbook: Data Table 1 - Projected Sales.xlsx)

But what if the growth rate in 2022 is higher than 1.75%, or what if the growth rate is even (heaven forbid) lower than anticipated? To create the one-variable table to answer these questions, you first bring forward the master formula in cell B5 to cell C7 with the formula =B5 (which appears as =Projected_Sales_2022 on the Formula bar as this is the range name given to the cell). Then, you enter the series of different growth rates as the input values in column B, starting in cell B8. (Cell B7, at the intersection of the row with the master formula and the column with the input values, must be left blank in a one-variable data table.) This series of input values for the data table can be created with the AutoFill feature. (See Book 2, Chapter 1 for details.) In this example, a data series that increments each succeeding value by 0.25% percent is created in the cell range B8:B17, starting at 1.00 percent and ending at 3.25% percent.

After bringing the formula in cell B5 forward to cell C7 with the linking formula =B5 and generating the growth rate series in the cell range

B8:B17, you then select the cell range B7:C17. In the Data tab's Forecast group, choose What-If Analysis ⇒ Data Table (or press Alt + AWT) to open the Data Table dialog box shown in Figure 1-1.

In this dialog box, you specify the row input cell in the Row Input Cell text box and/or the column input cell in the Column Input Cell text box. The cell that you designate as the row or column input cell in the Table dialog box must correspond to the cell in the worksheet that contains the original input value that is fed into the master formula.

In the data table in this example, you need to designate only B3 as the column input cell. (In the case of Figure 1-1, when you click this cell or use an arrow key to select this cell, Excel enters the absolute cell reference, as in $B$3.) You choose cell B3 because this cell contains the growth rate value used in the master formula.

After indicating the row or column input cells, Excel computes the data table when you click the OK button. In this example, the program creates the data table by substituting each input value in the data series in the range B8:B17 into the column input cell B3. The value of cell B3 is then used in the master formula to calculate a new result, which is entered in the corresponding cell in the cell range C8:C17. After the program has finished calculating the data table, Excel returns the original value to the row or column input cell (in this case, 1.75% in cell B3).

Figure 1-2 shows the completed data table. Here, you can see at a glance how changing a quarter percentage point for the growth rate affects the projected sales for 2022. After creating the data table, you can then format the results and save the table as part of the worksheet.

REMEMBER If you want to see how using a different range of variables affects the results in the table, you only need to enter the new input values in the existing range. By default, Excel automatically recalculates the results in the output range of a data table whenever you change any of its input values. If you want to control when each data table is recalculated while still allowing the formulas in the worksheet to be automatically recalculated, choose Formulas ⇒ Calculation Options ⇒ Automatic Except Data Tables (or press Alt + MXE).

Excel computes the results in a data table by creating an array formula that uses the TABLE function. (See Book 3, Chapter 1, for more information on array formulas.) In this example, the array formula entered into the cell range C8:C17 is as follows:

```
{=TABLE(, B3)}
```

The TABLE function can take two arguments, *row_ref* and/or *column_ref,* which represent the row input cell and column input cell for the data table, respectively. In this example, the data table uses only a column input cell, so B3 is the second and only argument of the TABLE function. Because Excel enters the results in a data table by using an array formula, Excel won't allow you to clear individual result cells in its output range. If you try to delete a single result in the data table, Excel displays an Alert dialog box, stating that you can't change part of a table.

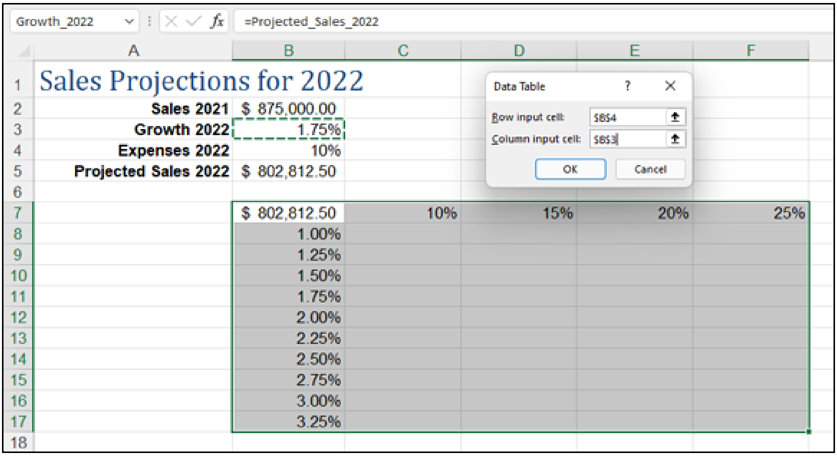
TIP If you want to delete just the results in the output range of a data table, you must select all the cells in the output range (cell range C8:C17, in the current example) before you press the Delete key or choose the Clear All option from the Clear button's drop-down menu (or press Alt+HEA).

Creating a two-variable data table

When you have a master formula in a worksheet in which you want to see the effect of changing two of its input values, you create a two-variable data table. When you create a two-variable data table, you enter two ranges of input values to be substituted in the master formula: a single-row range in the first row of the table and a single-column range in the first column of the data table. When you create a two-variable data table, you place a copy of the master formula in the cell at the intersection of this row and column of input values.

Figure 1-3 (sample workbook: Data Table 2 - Projected Sales.xlsx) shows the typical setup for a two-variable data table. This figure uses the projected sales worksheet shown previously in the section on a one-variable data table. Here, however, a second variable has been added to projecting the total sales in 2022. This worksheet contains a value in cell B4 (named Expenses_2022) that shows the projected percentage of expenses to sales, which is used, in turn, in the master formula in cell B5 as follows:

```
=Sales_2021 + (Sales_2021*Growth_2022)-(Sales_2021 *
Expenses_2022)
```



	A	B	C	D	E	F
1	Sales Projections for 2022					
2	Sales 2021	$ 875,000.00				
3	Growth 2022	1.75%				
4	Expenses 2022	10%				
5	Projected Sales 2022	$ 802,812.50				
6						
7		$ 802,812.50	10%	15%	20%	25%
8		1.00%				
9		1.25%				
10		1.50%				
11		1.75%				
12		2.00%				
13		2.25%				
14		2.50%				
15		2.75%				
16		3.00%				
17		3.25%				
18						

Data Table

Row input cell: $B$4

Column input cell: $B$3

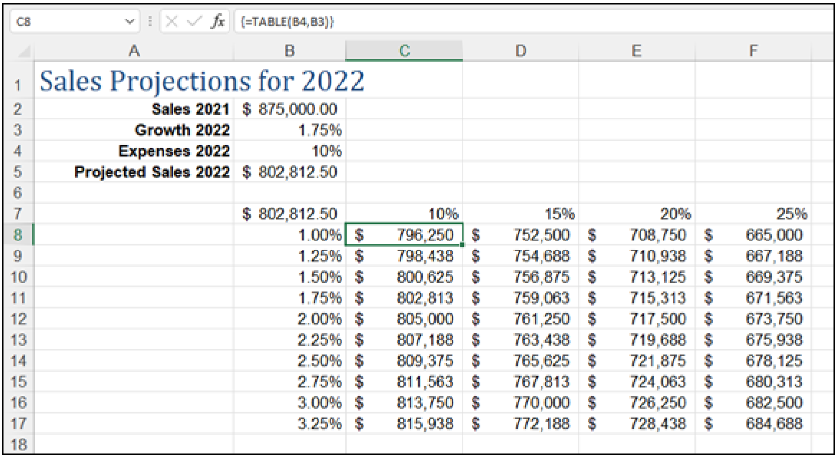
FIGURE 1-3: Creating a two-variable data table. (Sample workbook: Data Table 2 - Projected Sales.xlsx)

Note that when you factor in the expenses of 10% of the annual sales, the projected sales at an annual growth rate of 1.75% falls in cell B5 from $890,312.50 to $802,812.50.

To determine how changing both the growth rate and the percentage of expenses to sales will affect the projected sales for 2022, you create a two-variable data table. In setting up this table, you still enter the variable growth rates down column B in the cell range B8:B17. Then, you enter the variable expense rates across row 7 in the range C7:F7. This time, you bring forward the master formula by entering the formula **=B5** in cell B7, the cell at the intersection of the row and column containing the two input variables.

After setting up the two series of variables in this manner, you are ready to create the table by selecting the cell range B7:F17, and then choosing Data ⇒ What-If Analysis ⇒ Data Table (or pressing Alt+AWT) to open the Data Table dialog box, as shown in Figure 1-3. For a two-variable data table, you must designate both a row input and column cell in the worksheet. In this example, the row input cell is B4, which contains the original expense-to-sales percentage, and the column input cell remains B3, which contains the original growth rate. After these two input cells are entered in the Table dialog box, you are ready to generate the data table by clicking the OK button.

Figure 1-4 (sample workbook: Data Table 2 - Projected Sales.xlsx) shows the completed two-variable data table with the results of changing both the projected growth rate and the projected expenses. As with a one-variable data table, you can save this two-variable data table as part of your worksheet. You can also update the table by changing any of the (two types) input variables.



C8 {=TABLE(B4,B3)}

	A	B	C	D	E	F
1	Sales Projections for 2022					
2	**Sales 2021**	$ 875,000.00				
3	**Growth 2022**	1.75%				
4	**Expenses 2022**	10%				
5	**Projected Sales 2022**	$ 802,812.50				
6						
7		$ 802,812.50	10%	15%	20%	25%
8		1.00%	$ 796,250	$ 752,500	$ 708,750	$ 665,000
9		1.25%	$ 798,438	$ 754,688	$ 710,938	$ 667,188
10		1.50%	$ 800,625	$ 756,875	$ 713,125	$ 669,375
11		1.75%	$ 802,813	$ 759,063	$ 715,313	$ 671,563
12		2.00%	$ 805,000	$ 761,250	$ 717,500	$ 673,750
13		2.25%	$ 807,188	$ 763,438	$ 719,688	$ 675,938
14		2.50%	$ 809,375	$ 765,625	$ 721,875	$ 678,125
15		2.75%	$ 811,563	$ 767,813	$ 724,063	$ 680,313
16		3.00%	$ 813,750	$ 770,000	$ 726,250	$ 682,500
17		3.25%	$ 815,938	$ 772,188	$ 728,438	$ 684,688
18						

FIGURE 1-4: The completed two-variable data table. (Sample workbook: Data Table 2 - Projected Sales.xlsx)

The array formula entered in the output range (C8:F17) to create this two-variable data table is very similar to the one created previously for the one-variable data table, only this time the TABLE function uses both a *row_ref* and *column_ref* argument as follows:

```
{=TABLE(B4, B3)}
```

REMEMBER Because this data table used an array formula, you must select all the cells in the output range if you want to delete them.

Exploring Different Scenarios

Excel enables you to create and save sets of input values that produce different results as *scenarios* with the Scenario Manager feature. A scenario consists of a group of input values, each of which is associated with a cell in the worksheet. You assign the scenario a name, such as *Best Case, Worst Case, Most Likely Case,* and so on. When you select the name of the scenario that you want to use. Excel applies the input values stored in that scenario to the associated cells in the worksheet. You can then view the results that these input values produce in the worksheet. You can also use the Scenario Manager to create a summary report showing both the input values stored in each scenario and the key results produced by each.

Creating new scenarios

When creating a scenario for your worksheet, you create a worksheet that uses certain cells that change in each scenario (appropriately enough, called *changing cells*). To make it easier to identify the changing cells in each scenario that you create (especially in any scenario summary reports that you generate), you should assign range names to the variables in the worksheet before you create your scenarios.

To create your scenarios with the Scenario Manager, follow these steps:

1. **Select the changing cells in the worksheet — that is, the cells whose values vary in each of your scenarios.**

   Remember that you can select nonadjacent cells in the worksheet by holding down the Ctrl key as you click them.

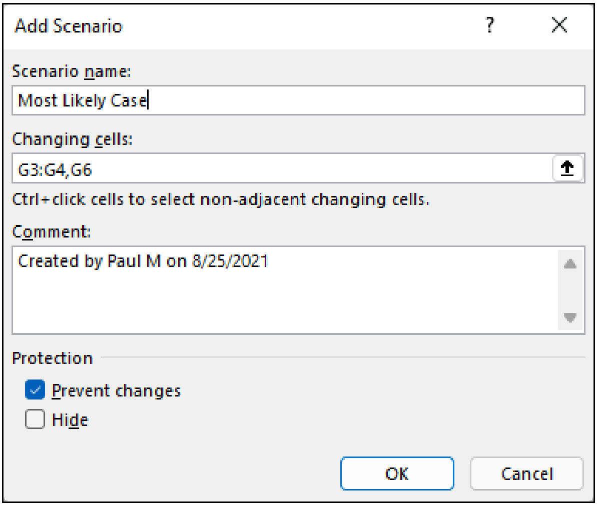
2. **Choose Data ⇒ What-If Analysis ⇒ Scenario Manager (press Alt + AWS).**

   Excel opens the Scenario Manager dialog box.

3. **Click Add.**

   Excel opens the Add Scenario dialog box, similar to the one shown in Figure 1-5 (sample workbook: Sales Forecast.xlsx). The Add Scenario dialog box contains a Scenario Name text box, where you give the new scenario a descriptive name such as *Best Case, Most Likely Case,* and so on. This dialog box also contains a

Changing Cells text box that contains the addresses of the variable cells that you selected in the worksheet, a Comment box that contains a note with your name, and the current date, so you'll always know when you created the particular scenario, and Protection check boxes that prevent users from making changes and/or enable you to hide the scenario when the worksheet is protected.



Scenario name:
Most Likely Case

Changing cells:
G3:G4,G6

Ctrl+click cells to select non-adjacent changing cells.

Comment:
Created by Paul M on 8/25/2021

Protection
☑ Prevent changes
☐ Hide

FIGURE 1-5: Adding a new Most Likely scenario for the sales forecast. (Sample workbook: Sales Forecast.xlsx)

4. **Type a descriptive name for the new scenario in the Scenario Name text box.**

   Now, you should check over the cell references in the Changing Cells text box to make sure that they're correct. You can modify them if necessary by clicking the Changing Cells text box and then by clicking the cells in the worksheet while holding down the Ctrl key. You can also edit the note in the Comment box if you want to add more information about your assumptions as part of the new scenario.

   By default, Excel protects a scenario from changes when you turn on protection for the worksheet (see Book 4, Chapter 1, for details) so that you can't edit or delete the scenario in any way. If you want Excel to hide the scenario as well when worksheet protection is turned on, click the Hide check box. If you don't want to protect or hide the scenario when worksheet protection is turned on, click the Prevent Changes check box to remove its check mark and leave the Hide check box as it is.

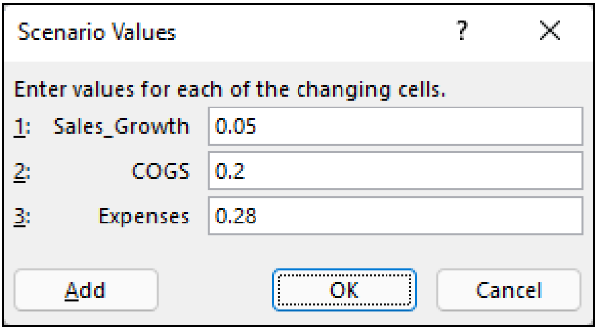
5. **In the Protection section of the Add Scenario dialog box, choose what kind of scenario protection that you need, if any, with the Prevent Changes and Hide check boxes.**

   Now you're ready to specify the changing values for the new scenario.

6. **Click OK in the Add Scenario dialog box.**

   This action closes the Add Scenario dialog box and then opens the Scenario Values dialog box, similar to the one shown in Figure 1-6 (sample workbook: Sales Forecast.xlsx). The Scenario Values dialog box numbers and shows the range name (assuming you named each of the cells), followed by the current value for each of the changing values that you selected in the worksheet before starting to define different scenarios for your worksheet.

   You can accept the values shown in the text box for each changing cell if it suits the current scenario that you're defining, or you can increase or decrease any or all of them as needed to reflect the scenario's assumptions.



Scenario Values

Enter values for each of the changing cells.

1: Sales_Growth 0.05

2: COGS 0.2

3: Expenses 0.28

FIGURE 1-6: Specifying the changing values in the Scenario Values dialog box. (Sample workbook: Sales Forecast.xlsx)

7. **Check the values in each changing cell's text box and modify the values as needed.**

   Now you're ready to close the Scenario Values dialog box, which completes the definition of the new scenario.

8. **Click the Add button in the Scenario Values dialog box.**

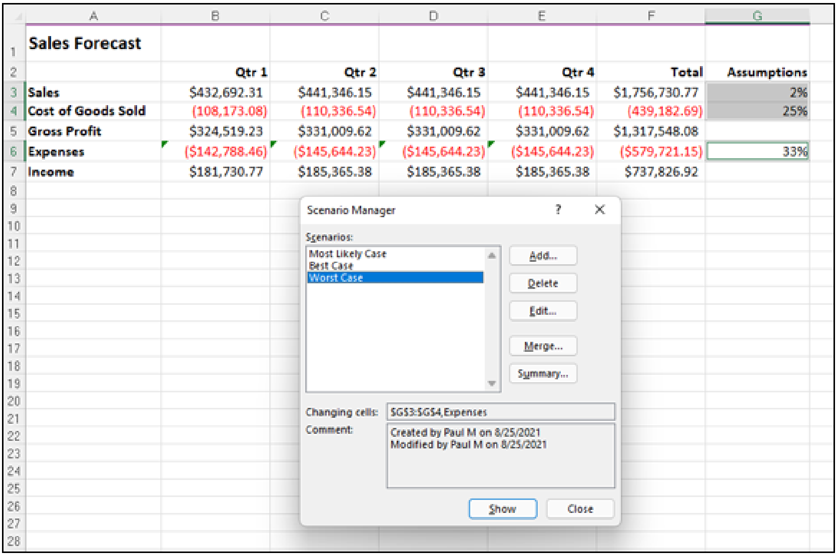
   The Scenario Values dialog box closes and you return to the Add Scenario dialog box, where you can define a new scenario name for the changing cells.

9. **Repeat Steps 4 to 8 to add all the other scenarios that you want to create.**

   After you finish defining all the different scenarios you want to apply to the changing values in the worksheet, you can close the Scenario Values dialog box and then return to the Scenario Manager dialog box, where you can use the Show button to see how using different sets of changing values affects your worksheet.

10. **Click OK in the Add Values dialog box and then click the Close button in the Scenario Manager dialog box.**

When you return to the Scenario Manager dialog box, the names of all the scenarios that you added appear in the Scenarios list box. For example, in Figure 1-7 (sample workbook: Sales Forecast.xlsx), you see that three scenarios — Most Likely, Best Case, and Worst Case — are now listed in the Scenarios list box.



	A	B	C	D	E	F	G
1	Sales Forecast						
2		Qtr 1	Qtr 2	Qtr 3	Qtr 4	Total	Assumptions
3	Sales	$432,692.31	$441,346.15	$441,346.15	$441,346.15	$1,756,730.77	2%
4	Cost of Goods Sold	(108,173.08)	(110,336.54)	(110,336.54)	(110,336.54)	(439,182.69)	25%
5	Gross Profit	$324,519.23	$331,009.62	$331,009.62	$331,009.62	$1,317,548.08	
6	Expenses	($142,788.46)	($145,644.23)	($145,644.23)	($145,644.23)	($579,721.15)	33%
7	Income	$181,730.77	$185,365.38	$185,365.38	$185,365.38	$737,826.92	

Scenario Manager

Scenarios:

Most Likely Case

Best Case

Worst Case

Changing cells: $G$3:$G$4,Expenses

Comment: Created by Paul M on 8/25/2021
Modified by Paul M on 8/25/2021

FIGURE 1-7: Worksheet after showing the Worst Case scenario. (Sample workbook: Sales Forecast.xlsx)

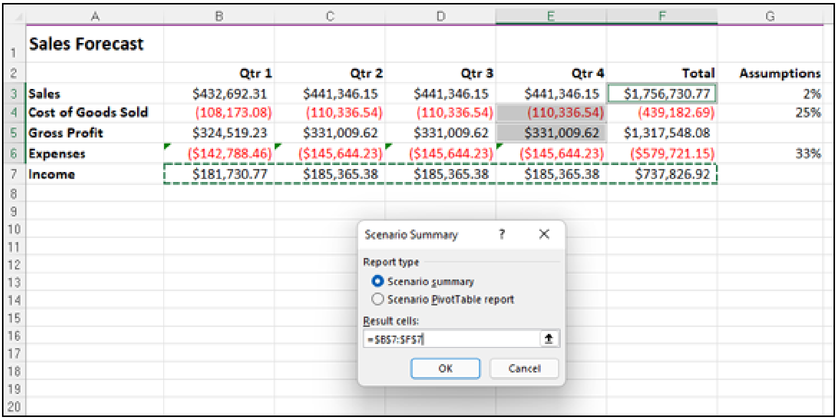
To show a particular scenario in the worksheet that uses the values you entered for the changing cells, you double-click the scenario name in this list box or click the name and then click the Show command button. Figure 1-7 shows the results in the sample forecast worksheet after showing the Worst Case scenario.

If, after creating the scenarios for your worksheet, you find that you need to use different input values or you want to add or remove scenarios, you can edit the scenarios in the Scenario Manager dialog box. To modify the scenario's name and/or the input values assigned to the changing cells of that scenario, click the scenario name in the Scenarios list box and then click the Edit button so that you can make the appropriate changes in the Edit Scenario dialog box. To remove a scenario from a worksheet, select the scenario's name in the Scenarios list box and then click the Delete button. Note, however, that if you delete a scenario in error, you can't restore it with the Undo command. Instead, you must re-create the scenario by using the Add command button as outlined in the previous steps.

You can also merge scenarios from other Excel workbook files that are open. (Of course, the workbooks must share the same worksheet layout and changing cells.) To merge a scenario into the current worksheet from another workbook, click the Merge button in the Scenario Manager dialog box and then select the workbook from the Book drop-down list box and the worksheet from the Sheet drop-down list box before you click OK. Excel then copies all the scenarios defined for that worksheet and merges them with any scenarios that you've defined for the current worksheet.

Producing a summary report

After creating the different scenarios for your worksheet, you can use the Summary button in the Scenario Manager dialog box to create a summary report that shows the changing values used in each scenario and, if you want, key resulting values that each produces. When you click the Summary button, Excel opens a Scenario Summary dialog box, similar to the one shown in Figure 1-8 (sample workbook: Sales Forecast.xlsx), where you may designate a cell selection of result cells in the Result Cells text box to be included in the report. After selecting the result cells for the report, click OK to have Excel generate the summary report and display it in a new worksheet window.



	A	B	C	D	E	F	G
1	Sales Forecast						
2		Qtr 1	Qtr 2	Qtr 3	Qtr 4	Total	Assumptions
3	Sales	$432,692.31	$441,346.15	$441,346.15	$441,346.15	$1,756,730.77	2%
4	Cost of Goods Sold	(108,173.08)	(110,336.54)	(110,336.54)	(110,336.54)	(439,182.69)	25%
5	Gross Profit	$324,519.23	$331,009.62	$331,009.62	$331,009.62	$1,317,548.08	
6	Expenses	($142,788.46)	($145,644.23)	($145,644.23)	($145,644.23)	($579,721.15)	33%
7	Income	$181,730.77	$185,365.38	$185,365.38	$185,365.38	$737,826.92	

Scenario Summary

Report type

● Scenario summary

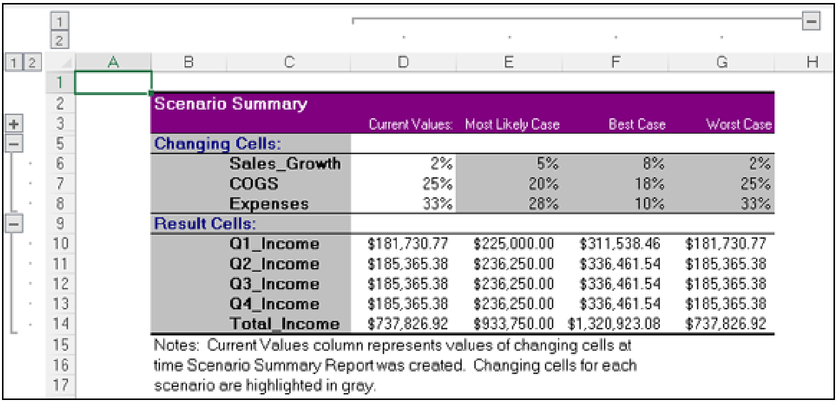
○ Scenario PivotTable report

Result cells:

=$B$7:$F$7

FIGURE 1-8: Designating the result cells in the Scenario Summary dialog box. (Sample workbook: Sales Forecast.xlsx)

In the example shown in Figure 1-8, the cell range C7:G7, containing the projected income figures for the sales forecast, are designated as the result cells to be included in the summary report. Figure 1-9 (sample workbook: Sales Forecast.xlsx) shows the actual summary report generated for this sample worksheet in a new document window. Note that because all the changing and result cells in this worksheet are named, the summary report uses their range names in place of their cell references. Also, when the Scenario Manager generates a summary report, it automatically outlines the summary data, thus creating two vertical levels — one for the changing cells and another for the result cells.



Scenario Summary

	Current Values:	Most Likely Case	Best Case	Worst Case
Changing Cells:				
Sales_Growth	2%	5%	8%	2%
COGS	25%	20%	18%	25%
Expenses	33%	28%	10%	33%
Result Cells:				
Q1_Income	$181,730.77	$225,000.00	$311,538.46	$181,730.77
Q2_Income	$185,365.38	$236,250.00	$336,461.54	$185,365.38
Q3_Income	$185,365.38	$236,250.00	$336,461.54	$185,365.38
Q4_Income	$185,365.38	$236,250.00	$336,461.54	$185,365.38
Total_Income	$737,826.92	$933,750.00	$1,320,923.08	$737,826.92

Notes: Current Values column represents values of changing cells at time Scenario Summary Report was created. Changing cells for each scenario are highlighted in gray.

FIGURE 1-9: A Scenario Summary report for the scenarios in the Sales Forecast table. (Sample workbook: Sales Forecast.xlsx)

TIP

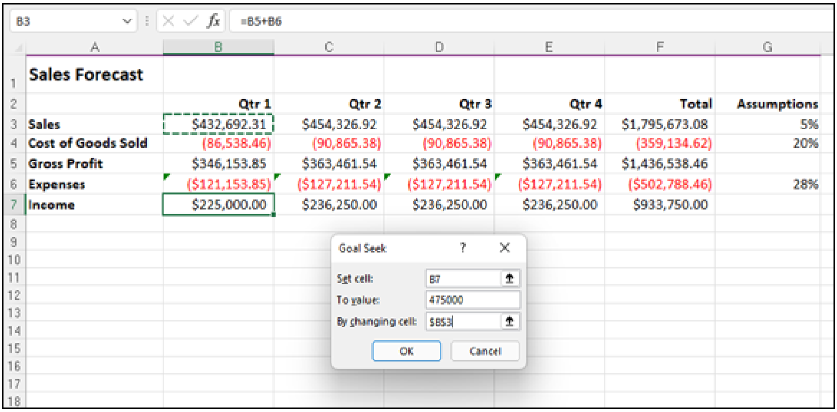
Note that the Scenario Summary dialog box contains an option, Scenario PivotTable Report, which enables you to view the scenario results as a pivot table. See Book 7, Chapter 2 for details on the uses of PivotTables.

Hide and Goal Seeking

Sometimes, you know the outcome that you want to realize in a worksheet, and you need Excel to help you find the input values necessary to achieve those results. This procedure, which is the opposite of the what-if analysis that I've been examining in this chapter, is referred to as *goal seeking*.

When you need to find the value for a single variable that will give the desired result in a particular formula, you can perform this simple type of goal seeking with the Goal Seek command. If you have charted the data and created a two-dimensional column, bar, or line chart, you can also perform the goal seeking by directly manipulating the appropriate marker on the chart. And when you need to perform more complex goal seeking, such as that which involves changing multiple input values to realize a result or constraining the values to a specific range, you can use Solver command.

To use the Goal Seek command, select the cell containing the formula that will return the result that you are seeking (referred to as the *set cell*), indicate what value you want this formula to return, and then indicate the location of the input value that Excel can change to return the desired result. Figures 1-10 and 1-11 (sample workbook: Sales Forecast.xlsx for both) illustrate how you can use the Goal Seek command to find how much sales must increase to realize first quarter income of $475,000 (given certain growth, cost of goods sold, and expense assumptions).

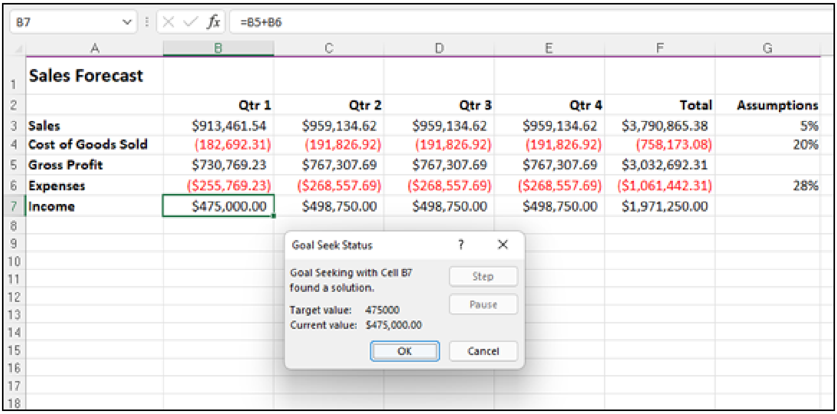


Sales Forecast

	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Total	Assumptions
Sales	$432,692.31	$454,326.92	$454,326.92	$454,326.92	$1,795,673.08	5%
Cost of Goods Sold	(86,538.46)	(90,865.38)	(90,865.38)	(90,865.38)	(359,134.62)	20%
Gross Profit	$346,153.85	$363,461.54	$363,461.54	$363,461.54	$1,436,538.46	
Expenses	($121,153.85)	($127,211.54)	($127,211.54)	($127,211.54)	($502,788.46)	28%
Income	$225,000.00	$236,250.00	$236,250.00	$236,250.00	$933,750.00	

Set cell: B7
To value: 475000
By changing cell: $B$3

FIGURE 1-10: Using goal seeking to find out how much sales must increase to reach a target income. (Sample workbook: Sales Forecast.xlsx)



Sales Forecast						
	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Total	Assumptions
Sales	$913,461.54	$959,134.62	$959,134.62	$959,134.62	$3,790,865.38	5%
Cost of Goods Sold	(182,692.31)	(191,826.92)	(191,826.92)	(191,826.92)	(758,173.08)	20%
Gross Profit	$730,769.23	$767,307.69	$767,307.69	$767,307.69	$3,032,692.31	
Expenses	($255,769.23)	($268,557.69)	($268,557.69)	($268,557.69)	($1,061,442.31)	28%
Income	$475,000.00	$498,750.00	$498,750.00	$498,750.00	$1,971,250.00	

Goal Seek Status

Goal Seeking with Cell B7 found a solution.

Target value: 475000

Current value: $475,000.00

FIGURE 1-11: A worksheet showing a goal-seeking solution and the Goal Seek Status dialog box. (Sample workbook: Sales Forecast.xlsx)

To find out how much sales must increase to return a net income of $475,000 in the first quarter, you first select cell B7, which contains the formula that calculates the first quarter income before you choose Data ⇒ What-If Analysis ⇒ Goal Seek (or press Alt + AWG). Excel opens the Goal Seek dialog box, similar to the one shown in Figure 1-10. Because cell B7 is the active cell when you open this dialog box, the Set Cell text box already contains the cell reference B7. You then select the To Value text box and enter **475000** as the goal. Then, you select the By Changing Cell text box and select cell B3 in the worksheet (the cell that contains the first quarter sales).

Figure 1-11 shows the Goal Seek Status dialog box that appears when you click OK in the Goal Seek dialog box to have Excel go ahead and adjust the sales figure to reach your desired income figure. As this figure shows, Excel increases the sales in cell B3 from $432,692.31 to $913,461.54 which, in turn, returns $475,000.00 as the income in cell B7. The Goal Seek Status dialog box informs you that goal seeking has found a solution and that the current value and target value are now the same. (If this were not the case, the Step and Pause buttons in the dialog box would become active, and you could have Excel perform further iterations to try to narrow and ultimately eliminate the gap between the target and current values.)

If you want to keep the values entered in the worksheet as a result of goal seeking, click OK to close the Goal Seek Status dialog box. If you want to return to the original values, click the Cancel button instead. If you change the value by clicking OK, you can still switch between the "before" and "after" input values and results by choosing Home ⇒ Undo or by pressing Ctrl + Z.

TIP To flip back and forth between the “after” and “before” values when you’ve closed the Goal Seek Status dialog box, press Ctrl+Z to display the original values before goal seeking and then Ctrl+Y to display the values engendered by the goal-seeking solution.

Using Solver

Although the Data Table and Goal Seek commands work just fine for simple problems that require determining the direct relationship between the inputs and results in a formula, you need to use the Solver add-in when dealing with more complex problems. For example, use Solver to find the best solution when you need to change multiple input values in your model and you need to impose constraints on these values and/or the output value.

Solver works by applying iterative methods to find the “best” solution given the inputs, desired solution, and the constraints that you impose. With each iteration, the program applies a trial-and-error method (based on the use of linear or nonlinear equations and inequalities) that attempts to get closer to the optimum solution.

When using Solver, keep in mind that many problems, especially the more complicated ones, have many solutions. Although Solver returns the optimum solution, given the starting values, the variables that can change, and the constraints that you define, this solution is often not the only one possible and, in fact, may not be the best solution for you. To be sure that you are finding the best solution, you may want to run Solver more than once, adjusting the initial values each time you solve the problem.

When setting up the problem for Solver in your worksheet, define the following items:

- **Objective cell:** The target cell in your worksheet whose value is to be maximized, minimized, or made to reach a particular value. Note that this cell must contain a formula.
- **Variable cells:** The changing cells in your worksheet whose values are to be adjusted until the answer is found.

- **Constraint cells:** The cells that contain the limits that you impose on the changing values in the variable cells and/or the target cell in the objective cell.

After you finish defining the problem with these parameters and have Solver solve the problem, the program returns the optimum solution by modifying the values in your worksheet. At this point, you can choose to retain the changes in the worksheet or restore the original values to the worksheet. You can also save the solution as a scenario to view later before you restore the original values.

TIP You can use Solver with the Scenario Manager to help set up a problem to solve or to save a solution so that you can view it later. The changing cells that you define for the Scenario Manager are automatically picked up and used by Solver when you select this command, and vice versa. Also, you can save Solver's solution to a problem as a scenario (by clicking the Save Scenario button in Solver dialog box) that you can then view with the Scenario Manager.

Setting up and defining the problem

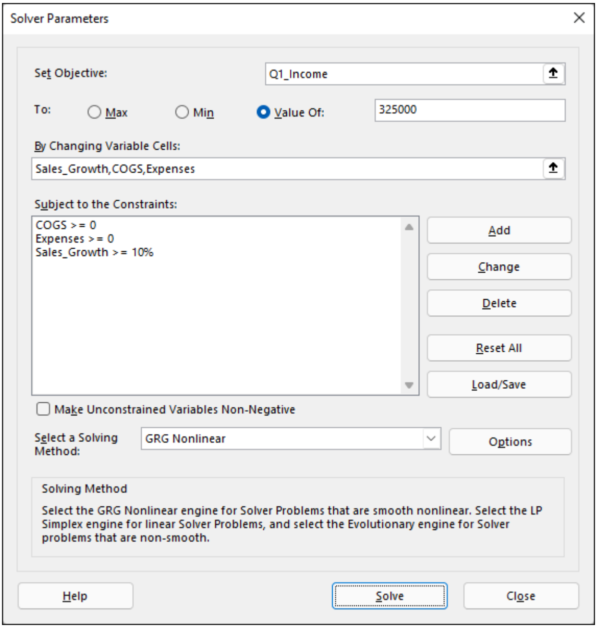
The first step in setting up a problem for Solver to work on is to create the worksheet model for which you will define the objective cell, variables cells, and the constraint cells.

REMEMBER Because Solver is an add-in utility, you need to make sure that Solver program is loaded. Choose File ⇒ Options ⇒ Add-Ins, make sure Add-Ins is selected in the Manage drop-down list, and then click Go. In the Add-Ins dialog box that appears, select the Solver Add-In check box and click OK. Excel adds the Solver command to the Data tab's Analysis group.

To define and solve a problem with Solver after you've loaded the add-in and have created your worksheet model, follow these steps:

1. **Choose Data ⇒ Solver.**

   Excel opens Solver Parameters dialog box, which is similar to the one shown in Figure 1-12 (sample workbook: Sales Forecast.xlsx).



Solver Parameters

Set Objective: Q1_Income

To: ○ Max ○ Min ● Value Of: 325000

By Changing Variable Cells: Sales_Growth,COGS,Expenses

Subject to the Constraints:

COGS >= 0
Expenses >= 0
Sales_Growth >= 10%

☐ Make Unconstrained Variables Non-Negative

Select a Solving Method: GRG Nonlinear

Solving Method

Select the GRG Nonlinear engine for Solver Problems that are smooth nonlinear. Select the LP Simplex engine for linear Solver Problems, and select the Evolutionary engine for Solver problems that are non-smooth.

FIGURE 1-12: Specifying the parameters to apply to the model in Solver Parameters dialog box. (Sample workbook: Sales Forecast.xlsx)

2. **Click the target cell in the worksheet or enter its cell reference or range name in the Set Objective text box.**
3. **Click the appropriate option button option in the To section of the dialog box. If you select the Value Of option button, enter the value to match in the associated text box.**

   Click the Max option button when you want the target cell's value to be as large as possible. Click the Min option button when you want the target cell's value to be as small as possible. Click the Value Of option button and then enter a value in the associated text box when you want the target cell's value to reach a particular value.

4. **Click the By Changing Variable Cells text box and then select the cells to change in the worksheet or enter their cell references or range name in the text box.**

   Remember that to select nonadjacent cells in the worksheet, you need to hold down the Ctrl key as you click each cell in the selection. To have Excel choose the changing cells for you based on the target cell that you selected, click the Guess button to the right of this text box.

5. **(Optional) Click the Add button to the right of the Subject to the Constraints list box in Solver Parameters dialog box.**

   You can add constraints for the target cell or any of the changing cells that determine its limits when adjusting the values. When defining a constraint in the Add Constraint dialog box, choose the cell whose value you want to constrain or select the cell in the worksheet or enter its cell reference in the Cell Reference text box. Then select the relationship (=, <=, >=, or *int* for integer or *bin* for binary) from the drop-down list box to the right and (unless you chose *int* or *bin*) enter the appropriate value or cell reference in the Constraint text box.

   To continue adding constraints for other cells used by Solver, click the Add button to add the constraint and clear the text boxes in the Add Constraint dialog box. Then, repeat Step 5 to add a new constraint. After you finish defining constraints for the target cell and changing values in the model, click OK to close the Add Constraint dialog box and return to the Solver Parameters dialog box (which now lists your constraints in the Subject to the Constraints list box).

6. **(Optional) Deselect the Make Unconstrained**

Variables Non-Negative check box if you want to allow negative values when the variable cells are not subject to constraints.

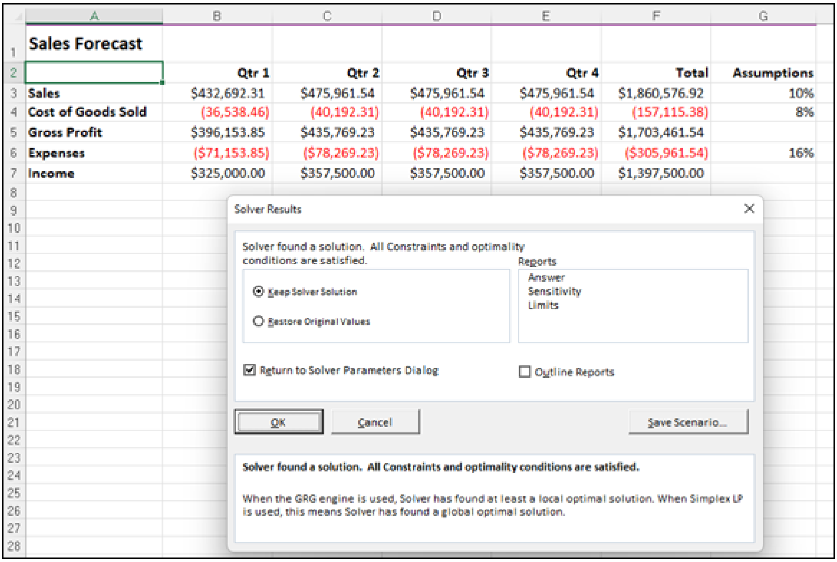
By default, Solver employs the GRG (Generalized Reduced Gradient) Nonlinear method in solving the model whose parameters you're setting known as a very efficient way to solve smooth nonlinear problems. To use the LP Simplex method (for Linear Programming following the Simplex algorithm) or Evolutionary engine for solving non-smooth problems, you need to follow Step 7.

7. **(Optional) Select LP Simplex or Evolutionary from the Select a Solving Method drop-down list to use either one of these methods solving nonsmooth problems.**
8. **Click the Solve button to have Solver solve the problem as you've defined it in Solver Parameters dialog box.**

Solving the problem

When you click the Solve button, the Solver Parameters dialog box disappears, and the Status bar indicates that Solver is setting up the problem and then keeps you informed of the progress in solving the problem by showing the number of the intermediate (or trial) solutions as they are tried. To interrupt the solution process at any time before Excel calculates the last iteration, press the Esc key. Excel then displays the Show Trial Solution dialog box, informing you that the solution process has been paused. To continue the solution process, click the Continue button. To abort the solution process, click the Stop button.

When Excel finishes the solution process, the Solver Results dialog box appears, similar to the one shown in Figure 1-13 (sample workbook: Sales Forecast.xlsx). This dialog box informs you whether Solver was able to find a solution, given the target cell, changing cells, and constraints defined for the problem. To retain the changes that Solver makes in your worksheet model, leave the Keep Solver Solution option button selected and click OK to close the Solver Results dialog box. To return the original values to the worksheet, click the Restore Original Values option button instead. To save the changes as a scenario before you restore the original values, click the Save Scenario button and assign a name to the current scenario before you select the Restore Original Values option and click OK.



Sales Forecast						
	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Total	Assumptions
Sales	$432,692.31	$475,961.54	$475,961.54	$475,961.54	$1,860,576.92	10%
Cost of Goods Sold	(36,538.46)	(40,192.31)	(40,192.31)	(40,192.31)	(157,115.38)	8%
Gross Profit	$396,153.85	$435,769.23	$435,769.23	$435,769.23	$1,703,461.54	
Expenses	($71,153.85)	($78,269.23)	($78,269.23)	($78,269.23)	($305,961.54)	16%
Income	$325,000.00	$357,500.00	$357,500.00	$357,500.00	$1,397,500.00	

Solver Results

Solver found a solution. All Constraints and optimality conditions are satisfied.

● Keep Solver Solution

○ Restore Original Values

☑ Return to Solver Parameters Dialog

☐ Outline Reports

Solver found a solution. All Constraints and optimality conditions are satisfied.

When the GRG engine is used, Solver has found at least a local optimal solution. When Simplex LP is used, this means Solver has found a global optimal solution.

FIGURE 1-13: The Solver Results dialog box showing that Solver found a solution to the problem. (Sample workbook: Sales Forecast.xlsx)

WARNING Unlike when using the Goal Seek command, after clicking the Keep Solver Solution option button in Solver Results dialog box, you can't use the Undo command button on the Quick Access toolbar to restore the original values to your worksheet. If you want to be able to switch between the "before" and "after" views of your worksheet, you must save the changes with the Save Scenario button and then select the Restore Original Values option button. That way, you can retain the "before" view in the original worksheet and use the Scenario Manager to display the "after" view created by Solver.

Changing Solver options

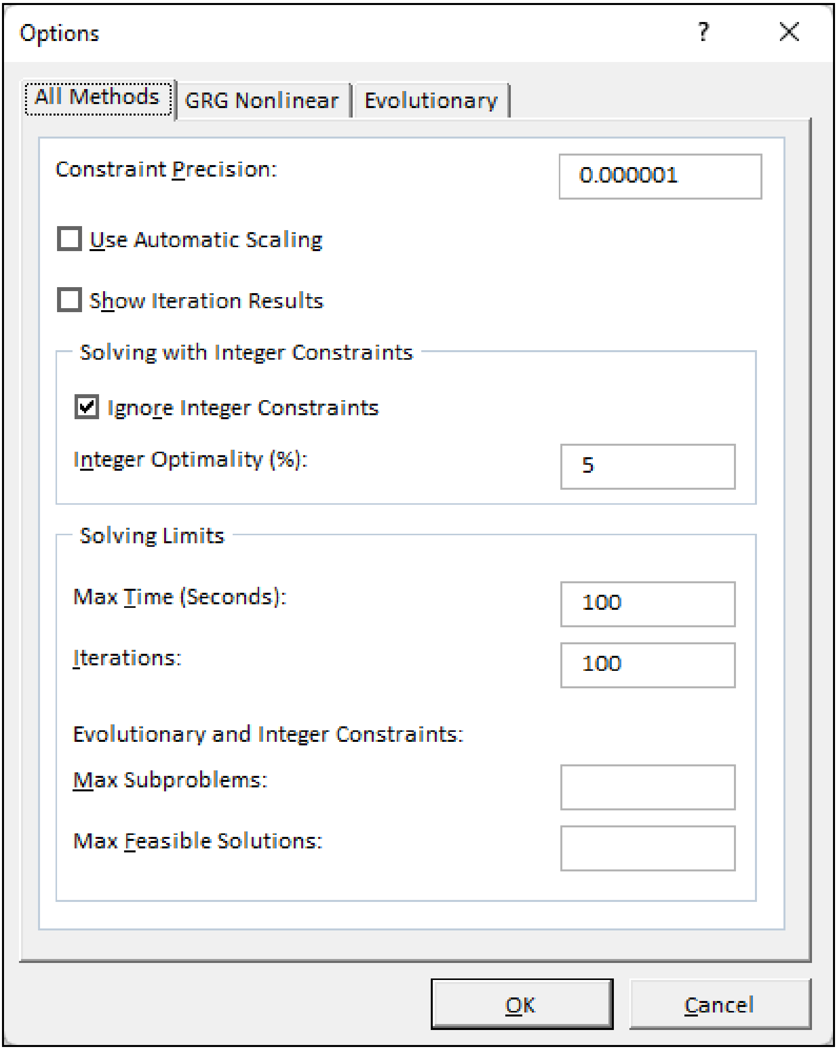
For most of the problems, the default options used by Solver are adequate. In some situations, however, you may want to change some of the Solver options before you begin the solution process. To change the solution options, click the Options button in the Solver Parameters dialog box. Excel then opens the Options dialog box with the All Methods tab selected, shown in Figure 1-14, where you can make all necessary changes. (See Table 1-1 for information on each option.)

TABLE 1-1 Solver Option Settings

Option	*Function*
Constraint Precision	Specifies the precision of the constraints. The number that you enter in this text box determines whether the value in a constraint cell meets the specified value or the upper or lower limit you have set. Specify a lower number (between 0 and 1) to reduce the time it takes Solver to return a solution to your problem.
Use Automatic Scaling	Select this check box to have Solver automatically scale the results when solving the problem.
Show Iteration Results	Select this check box to have Solver show the results for the iterations followed in solving the problem.
Ignore Integer Constraints	Select this check box to have Solver ignore any constraints you specify that use integers.
Integer Optimality (%)	Specifies the percentage of integer optimality criteria that Solver applies in solving the problem.
Max Time (seconds)	Specifies the maximum number of seconds that Solver will spend on finding the solution.
Iterations	Specifies the maximum number of times that Solver will recalculate the worksheet when finding the solution.
Max Subproblems	Specifies the maximum number of subproblems that Solver takes on when using the Evolutionary method to solve the problem.
Max Feasible Solutions	Specifies the maximum number of feasible solutions that Solver will pursue when you select the Evolutionary method for solving the problem.

After changing the options, click OK to return to the Solver Parameters dialog box; from here, you can then click the Solve button to begin the solution process with the new solution settings that you just changed.

TIP When you use the default GRG (Generalized Reduced Gradient) Nonlinear or Evolutionary method, you can set additional Solver settings using the options on the GRG Nonlinear and Evolutionary tabs of the Options dialog box. These options include changing the Converge, Population Size, and Random Seed settings for either of these particular methods.



Constraint Precision: 0.000001

☐ Use Automatic Scaling

☐ Show Iteration Results

Solving with Integer Constraints

☑ Ignore Integer Constraints

Integer Optimality (%): 5

Solving Limits

Max Time (Seconds): 100

Iterations: 100

Evolutionary and Integer Constraints:

Max Subproblems:

Max Feasible Solutions:

FIGURE 1-14: Modifying the solution options in the Options dialog box.

Saving and loading a model problem

The objective cell, variable cells, constraint cells, and Solver options that you most recently used are saved as part of the worksheet when you click the Save button (or press Ctrl+S). When you define other problems for the same worksheet that you want to save, you must click the Save Model button in the Solver Options dialog box and indicate the cell reference or name of the range in the active worksheet where you want the problem's parameters to be inserted.

When you click the Load/Save button, Excel opens the Load/Save Model dialog box, containing a Select Model Area text box. This text box contains the cell references for a range large enough to hold all the problem's parameters, starting with the active cell. To save the problem's parameters in this range, click OK. If this range includes cells with existing data, you need to modify the cell reference in this text box before you click OK to prevent Excel from replacing the existing data.

After you click OK, Excel copies the problem's parameters in the specified range. These values are then saved as part of the worksheet the next time you save the workbook. To reuse these problem parameters when solving a problem, you need to open Solver Options dialog box, click the Load/Save button to open the Load/Save Model dialog box, click the Load button, and then select the range containing the saved problem parameters. When you click OK in the Load Model dialog box, Excel loads the parameters from this cell range into the appropriate text boxes in Solver Parameters dialog box. You can then close the Solver Options dialog box by clicking OK, and you can solve the problem by using these parameters by clicking the Solve command button.

REMEMBER You can use the Reset All button whenever you want to clear all the parameters defined for the previous problem and return the Solver options to their defaults.

Creating Solver reports

You can create three different types of reports with Solver:

- **Answer report:** Lists the target cell and changing cells with their original and final values, along with the constraints used in solving the problem.
- **Sensitivity report:** Indicates how sensitive an optimal solution is to changes in the formulas that calculate the target cell and constraints. The report shows the changing cells with their final values and the *reduced gradient* for each cell. (The reduced gradient measures the objective per unit increase in the changing cell.) If you defined constraints, the Sensitivity report lists them with their final values and the *Lagrange multiplier* for each constraint. (The Lagrange multiplier measures the objective per unit increase that appears in the right side of the constraint equation.)

- **Limits report:** Shows the target cell and the changing cells with their values, lower and upper limits, and target results. The lower limit represents the lowest value that a changing cell can have while fixing the values of all other cells and still satisfying the constraints. The upper limit represents the highest value that will do this.

Excel places each report that you generate for a Solver problem in a separate worksheet in the workbook. To generate one (or all) of these reports, select the report type (Answer, Sensitivity, or Limits) from the Reports list box of the Solver Results dialog box (as shown previously in Figure 1-13). To select more than one report, just click the name of the report.

When you click OK to close the Solver Results dialog box (after choosing between the Keep Solver Solution and Restore Original Values options), Excel generates the report (or reports) that you selected in a new worksheet that it adds to the beginning of the workbook. (Report sheet tabs are named by report type, as in *Answer Report 1, Sensitivity Report 1,* and *Limits Report 1.*)

Chapter 2

Performing Large-Scale Data Analysis

IN THIS CHAPTER

- **Analyzing worksheet data with PivotTables and PivotCharts**
- **Analyzing worksheet data with the Power Pivot add-in**
- **Analyzing data visually over time with 3D Maps**
- **Analyzing data trends in a visual forecast worksheet**

The subject of this chapter is performing data analysis on a larger scale in Excel worksheets, often with visual components that enable you and your users to immediately spot developing trends. The primary Excel tool for performing such large-scale analysis on your worksheet data is the PivotTable and its visual counterpart, the PivotChart. PivotTables enable you to quickly summarize large amounts of data revealing inherent relationships and trends, whereas PivotCharts enable you to easily visualize these connections.

You also have access to Excel's Power Pivot add-in when you need to perform analysis on data models whose tables contain huge amounts of data. Finally, Excel offers two visual data analysis features designed to help you quickly identify significant indicators of your business's health and well-being: 3D Maps, which produces stunning, interactive, 3-D maps animating data over time, and Forecast Sheet, which generates worksheets showing developing trends in your data.

Creating PivotTables

PivotTable is the name given to a special type of data summary table that you can use to analyze and reveal the relationships inherent in the tables that you maintain in Excel. PivotTables are great for summarizing particular values in a table or range because they do their magic without making you create formulas to perform the calculations. Unlike Subtotals, which is another summarizing feature (see Book 6, Chapter 1 for more information), PivotTables let you play around with the arrangement of the summarized data — even after you generate the table. (The Subtotals feature only lets you hide and display different levels of totals in the table.) This capability to change the arrangement of — that is, to *pivot* — the summarized data by rotating row and column headings gives the PivotTable its name.

PivotTables are also versatile because they enable you to summarize data by using a variety of summary functions (although totals created with the SUM function will probably remain your old standby). You can also use PivotTables to cross-tabulate one set of data in your range or table with another. For example, you can use this feature to create a PivotTable from an employee database that totals the salaries for each job category cross-tabulated (arranged) by department or job site. Moreover, Excel makes it easy to create PivotTables that summarize data from more than one related table entered in the worksheet or retrieved from external data in what's known as a Data Model. (See Book 6, Chapter 2 for more on relating tables and retrieving external data.)

REMEMBER You can create a PivotTable from either a table or a range, provided the latter has column headings. So, in the sections that follow, when I say "table," what I really mean is "table or range."

Excel offers several methods for creating new PivotTables in your worksheets:

- **Quick Analysis tool:** With all the cells in the table selected, click the Quick Analysis tool and then select your PivotTable on the Tables tab of its drop-down palette.
- **Recommended PivotTables button:** With the cell pointer in one of the cells of a table, click the Recommended PivotTables button on the Insert tab and then select your PivotTable in the Recommended PivotTables dialog box.
- **PivotTable button:** With the cell pointer in one of the cells of a table, click the PivotTable button on the Insert tab and then use the Create PivotTable dialog box to specify the contents and

location of your new table before you manually select the fields in the data source to use.

Creating PivotTables with the Quick Analysis tool

Excel enables you to create a new PivotTable using a range or table selected in your worksheet with its Quick Analysis tool. To preview various types of PivotTables that Excel can create for you on the spot using the entries in a table that you have open in an Excel worksheet, follow these steps:

1. **Select all the data (including the column headings) as a cell range in the worksheet.**

   REMEMBER If you've assigned a range name to the data, you can select the column headings and all the data records in one operation by choosing the name from the Name box drop-down menu.

2. **Click the Quick Analysis tool that appears right below the lower-right corner of the current cell selection.**

   Excel opens the palette of Quick Analysis options with the initial Formatting tab selected and its various conditional formatting options displayed.

3. **Click the Tables tab at the top of the Quick Analysis options palette.**

   Excel displays its Table and PivotTable option buttons. The Table button previews how the selected data would appear formatted as a table. The other PivotTable buttons preview the various types of PivotTables that can be created from the selected data.

4. **To preview each PivotTable that Excel can create**

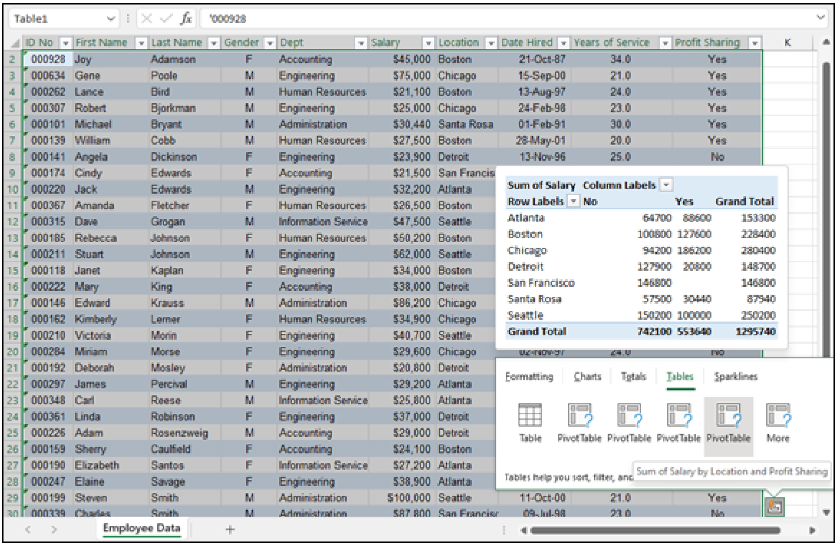
for your data, highlight its PivotTable button in the Quick Analysis palette.

As you highlight each PivotTable button in the options palette, Excel’s Live Preview feature displays a thumbnail of a PivotTable that can be created using your table data. This thumbnail appears above the Quick Analysis options palette for as long as the mouse or Touch pointer is over its corresponding button.

5. **When a preview of the PivotTable you want to create appears, click its button in the Quick Analysis options palette to create it.**

   Excel then creates the previewed PivotTable on a new worksheet that's inserted before the active worksheet. This new worksheet containing the PivotTable is active so that you can immediately rename and relocate the sheet as well as edit the new PivotTable, if you wish.

Figures 2-1 and 2-2 (sample workbook: Employee Table.xlsx for both) show you how this procedure works. In Figure 2-1, I’ve highlighted the fourth suggested PivotTable button in the Quick Analysis tool’s option palette. The previewed table in the thumbnail displayed above the palette shows the salaries subtotals and grand totals in the Employee Table organized by whether the employees participate in profit sharing (Yes or No).



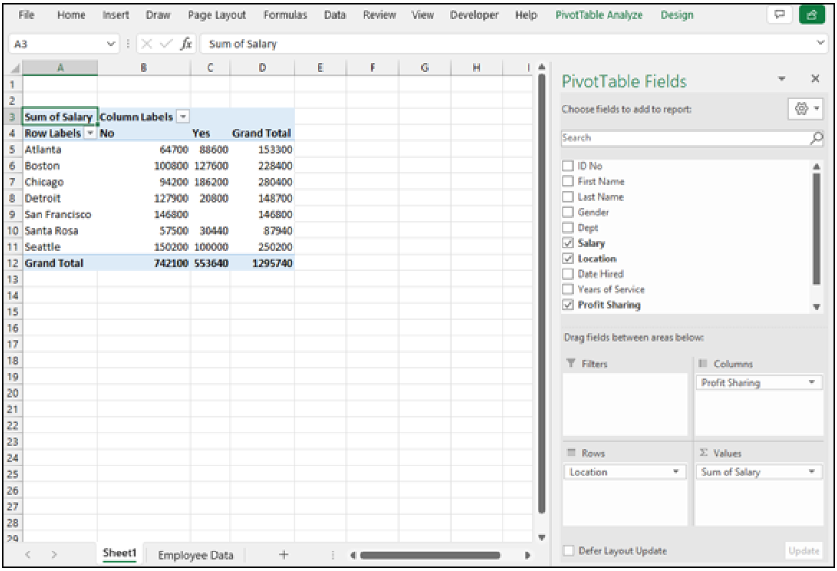
	ID No	First Name	Last Name	Gender	Dept	Salary	Location	Date Hired	Years of Service	Profit Sharing
2	000928	Joy	Adamson	F	Accounting	$45,000	Boston	21-Oct-87	34.0	Yes
3	000634	Gene	Poole	M	Engineering	$75,000	Chicago	15-Sep-00	21.0	Yes
4	000262	Lance	Bird	M	Human Resources	$21,100	Boston	13-Aug-97	24.0	Yes
5	000307	Robert	Bjorkman	M	Engineering	$25,000	Chicago	24-Feb-98	23.0	Yes
6	000101	Michael	Bryant	M	Administration	$30,440	Santa Rosa	01-Feb-91	30.0	Yes
7	000139	William	Cobb	M	Human Resources	$27,500	Boston	28-May-01	20.0	Yes
8	000141	Angela	Dickinson	F	Engineering	$23,900	Detroit	13-Nov-96	25.0	No
9	000174	Cindy	Edwards	F	Accounting	$21,500	San Francis			
10	000220	Jack	Edwards	M	Engineering	$32,200	Atlanta			
11	000367	Amanda	Fletcher	F	Human Resources	$26,500	Boston			
12	000315	Dave	Grogan	M	Information Service	$47,500	Seattle			
13	000185	Rebecca	Johnson	F	Human Resources	$50,200	Boston			
14	000211	Stuart	Johnson	M	Engineering	$62,000	Seattle			
15	000118	Janet	Kaplan	F	Engineering	$34,000	Boston			
16	000222	Mary	King	F	Accounting	$38,000	Detroit			
17	000146	Edward	Krauss	M	Administration	$86,200	Chicago			
18	000162	Kimberly	Lerner	F	Human Resources	$34,900	Chicago			
19	000210	Victoria	Morin	F	Engineering	$40,700	Seattle			
20	000284	Miriam	Morse	F	Engineering	$29,600	Chicago	02-Nov-97	24.0	No
21	000192	Deborah	Mosley	F	Administration	$20,800	Detroit			
22	000297	James	Percival	M	Engineering	$29,200	Atlanta			
23	000348	Carl	Reese	M	Information Service	$25,800	Atlanta			
24	000361	Linda	Robinson	F	Engineering	$37,000	Detroit			
25	000226	Adam	Rosenzweig	M	Accounting	$29,000	Detroit			
26	000159	Sherry	Caulfield	F	Accounting	$24,100	Boston			
27	000190	Elizabeth	Santos	F	Information Service	$27,200	Atlanta			
28	000247	Elaine	Savage	F	Engineering	$38,900	Atlanta			
29	000199	Steven	Smith	M	Administration	$100,000	Seattle	11-Oct-00	21.0	Yes
30	000339	Charles	Smith	M	Administration	$87,800	San Francisc	09-Jul-98	23.0	No

Sum of Salary	Column Labels		
Row Labels	No	Yes	Grand Total
Atlanta	64700	88600	153300
Boston	100800	127600	228400
Chicago	94200	186200	280400
Detroit	127900	20800	148700
San Francisco	146800		146800
Santa Rosa	57500	30440	87940
Seattle	150200	100000	250200
Grand Total	742100	553640	1295740

FIGURE 2-1: Previewing the PivotTable created from the selected data in the Quick Analysis options palette. (Sample workbook: Employee Table.xlsx)

Figure 2-2 shows you the PivotTable that Excel created when I clicked the highlighted button in the options palette in Figure 2-1. Note this PivotTable is selected on its own worksheet (Sheet1) that's been inserted in front of the Employee Data worksheet. Because the new PivotTable is selected, the PivotTable Fields task pane is displayed on the right side of the Excel worksheet window and the PivotTable Analyze and Design contextual tabs are displayed on the Ribbon. You can use the options on this task pane and these contextual tabs to customize your new PivotTable as described in the "Formatting a PivotTable" section later in this chapter.

REMEMBER Note that if Excel can't suggest any PivotTables to create from the selected data in the worksheet, a single Blank PivotTable button is displayed after the Table button in the Quick Analysis tool's options on the Tables tab. You can select this button to manually create a new PivotTable for the data as described later in this chapter.


File
Home
Insert
Draw
Page Layout
Formulas
Data
Review
View
Developer
Help
PivotTable Analyze
Design
A3
Sum of Salary
PivotTable Fields
Choose fields to add to report:
Search
Drag fields between areas below:
Filters
Columns
Rows
Values
Defer Layout Update
Update
Sheet1
Employee Data

Sum of Salary	Column Labels		
Row Labels	No	Yes	Grand Total
Atlanta	64700	88600	153300
Boston	100800	127600	228400
Chicago	94200	186200	280400
Detroit	127900	20800	148700
San Francisco	146800		146800
Santa Rosa	57500	30440	87940
Seattle	150200	100000	250200
Grand Total	742100	553640	1295740

☐ ID No
☐ First Name
☐ Last Name
☐ Gender
☐ Dept
☑ Salary
☑ Location
☐ Date Hired
☐ Years of Service
☑ Profit Sharing

Columns: Profit Sharing
Rows: Location
Values: Sum of Salary

FIGURE 2-2: Previewed PivotTable created on a new worksheet with the Quick Analysis tool. (Sample workbook: Employee Table.xlsx)

Creating recommended PivotTables

If creating a new PivotTable with the Quick Analysis tool (described in the previous section) is too much work for you, you can quickly generate a PivotTable with the Recommended PivotTables command button. To use this method, follow these three steps:

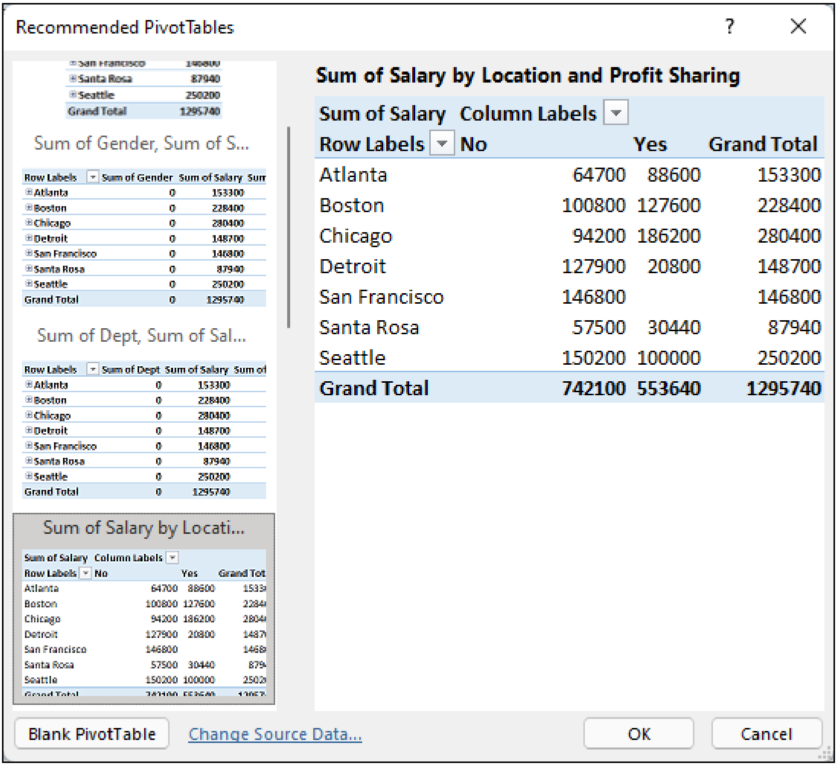
1. **Select a cell in the table you want to use as the source data for the new PivotTable.**

   Provided that the table has a row of column headings with contiguous rows of data as described in Book 6, Chapter 1, this can be any cell in the table.

2. **Choose Insert ⇒ Recommended PivotTables (or press Alt + NSP).**

   Excel displays a Recommended PivotTables dialog box similar to the one shown in Figure 2-3 (sample workbook: Employee Table.xlsx). This dialog box contains a list box on the left side that shows samples of all the suggested PivotTables that Excel can create from the data in your table.

3. **Select the sample of the PivotTable you want to create in the list box on the left and then click OK.**


Recommended PivotTables
?
Sum of Gender, Sum of S...
Sum of Dept, Sum of Sal...
Sum of Salary by Locati...
Blank PivotTable
Change Source Data...
OK
Cancel

Row Labels	Sum of Gender	Sum of Salary	Sum
⊞Atlanta	0	153300	
⊞Boston	0	228400	
⊞Chicago	0	280400	
⊞Detroit	0	148700	
⊞San Francisco	0	146800	
⊞Santa Rosa	0	87940	
⊞Seattle	0	250200	
Grand Total	0	1295740	

Row Labels	Sum of Dept	Sum of Salary	Sum of
⊞Atlanta	0	153300	
⊞Boston	0	228400	
⊞Chicago	0	280400	
⊞Detroit	0	148700	
⊞San Francisco	0	146800	
⊞Santa Rosa	0	87940	
⊞Seattle	0	250200	
Grand Total	0	1295740	

Sum of Salary by Location and Profit Sharing

Sum of Salary	Column Labels		
Row Labels	**No**	**Yes**	**Grand Total**
Atlanta	64700	88600	153300
Boston	100800	127600	228400
Chicago	94200	186200	280400
Detroit	127900	20800	148700
San Francisco	146800		146800
Santa Rosa	57500	30440	87940
Seattle	150200	100000	250200
Grand Total	**742100**	**553640**	**1295740**

FIGURE 2-3: Creating a new PivotTable from the sample PivotTables displayed in the Recommended PivotTables dialog box. (Sample workbook: Employee Table.xlsx)

Excel creates a new PivotTable based on the selected sample on its own worksheet inserted just before the worksheet that contains the source table. This PivotTable is selected on the new sheet so that the PivotTable Fields task pane is displayed on the right side of the Excel worksheet window and the PivotTable Analyze and Design contextual tabs are displayed on the Ribbon. You can use the options on this task pane and these contextual tabs to then customize your new PivotTable as described in the "Formatting a PivotTable" section later in this chapter.

Creating PivotTables manually

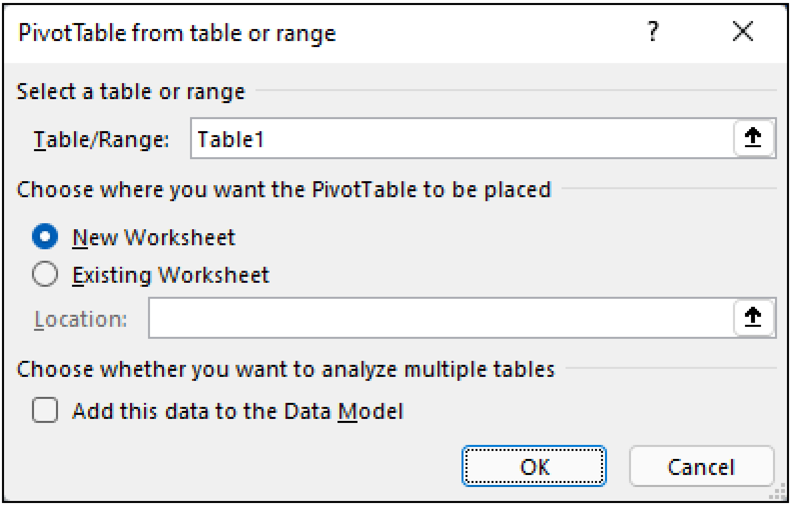
Creating PivotTables with the Quick Analysis tool or the Recommended PivotTables button on the Insert tab is fine provided you're only summarizing the data stored in a single table that's stored in your Excel worksheet.

When you want your PivotTable to work with data from fields in more than one (related) data table or with data stored in a table that doesn't reside in your worksheet (as when connecting with an external data source; see Book 6, Chapter 2), you need to manually create the PivotTable.

Creating a PivotTable with local data

To manually create a new PivotTable using a table stored in your Excel workbook, open the worksheet that contains that table (see Book 6, Chapter 1) you want summarized by the PivotTable, position the cell pointer somewhere in the cells of this table, and then choose Insert ⇒ PivotTable ⇒ From Table/Range (or press Alt+NVT).

Excel selects all the data in the table (indicated by a marquee around the cell range) and then opens the PivotTable from Table or Range dialog box similar to the one shown in Figure 2-4 (sample workbook: Employee Table.xlsx). You can then adjust the value in the Table/Range text box if the displayed range name or range reference doesn't include all the data to be summarized in the PivotTable.



PivotTable from table or range

Select a table or range

Table/Range: Table1

Choose where you want the PivotTable to be placed

● New Worksheet

○ Existing Worksheet

Location:

Choose whether you want to analyze multiple tables

☐ Add this data to the Data Model

FIGURE 2-4: Indicate the data source and PivotTable location in the Create PivotTable dialog box. (Sample workbook: Employee Table.xlsx)

By default, Excel builds the new PivotTable on a new worksheet it inserts just before the worksheet that contains your table. If you want the PivotTable to appear on the same worksheet, select the Existing Worksheet option button and then indicate the location of the first cell of the new table in the Location text box. (Just be sure that this new PivotTable isn't going to overlap any existing tables of data.)

REMEMBER If the table you've selected in the Table/Range text box is related to another table in your workbook and you want to be able to analyze and summarize data from both, be sure to select the Add This Data to the Data Model check box at the bottom of the Create PivotTable dialog box before you click OK. (See Book 6, Chapter 2 for details on creating relationships between tables using key fields.)

Creating a PivotTable from external data

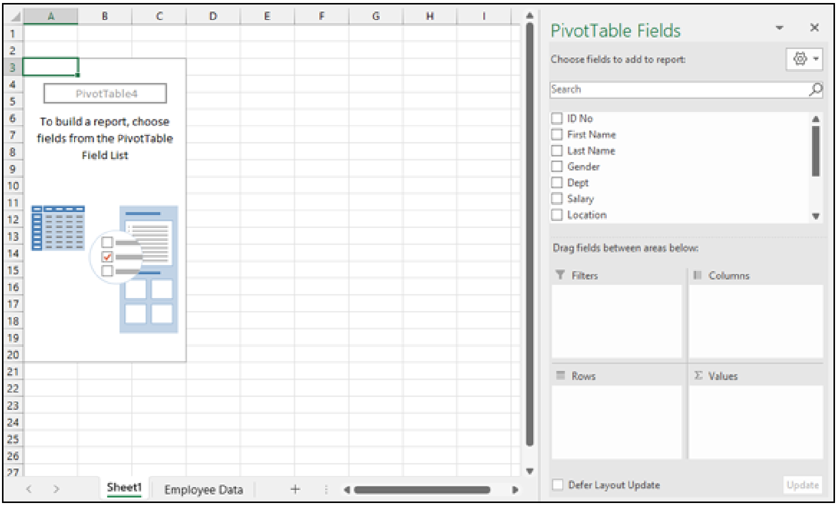
If you're creating a PivotTable using external data not stored in your workbook, you want to locate the cell pointer in the first cell of the worksheet where you want the PivotTable before opening the PivotTable from an External Data Source dialog box by choosing Insert ⇒ PivotTable ⇒ From External Data Source (or press Alt + NVE).

To specify the external data table to use, click the Choose Connection button to open the Existing Connections dialog box, where you select the name of the connection you want to use and then click Open. (See Book 6, Chapter 2 for information on establishing connections with external database tables.)

Excel then returns you to the PivotTable from an External Data Source dialog box, where the name of the selected external data connection is displayed after the Use an External Data Source heading. You can then modify the location settings, if need be, before creating the new PivotTable by clicking OK. Note that the Add This Data to the Data Model check box is automatically selected (and cannot be deselected) — the relationships between the data tables in the source database specified by the external data connection are automatically reflected in fields displayed in the Field list for the new PivotTable.

Constructing the new PivotTable

Whether you create your new PivotTable from a table or an external data source, Excel adds a placeholder graphic (with the text, "To build a report, choose fields from the PivotTable Field List") indicating where the new PivotTable will go in the worksheet and displays the PivotTable Fields task pane on the right side of the worksheet area, as shown in Figure 2-5 (sample workbook: Employee Table.xlsx).


A
B
C
D
E
F
G
H
I
PivotTable4
Sheet1
Employee Data
PivotTable Fields
Choose fields to add to report:
Search
☐ ID No
☐ First Name
☐ Last Name
☐ Gender
☐ Dept
☐ Salary
☐ Location
Drag fields between areas below:
Filters
Columns
Rows
Σ Values
☐ Defer Layout Update
Update

To build a report, choose fields from the PivotTable Field List

FIGURE 2-5: A new PivotTable displaying the blank table grid and the PivotTable Fields List task pane. (Sample workbook: Employee Table.xlsx)

This PivotTable Fields task pane is divided into two areas: the Choose Fields to Add to Report list box with a check box for each field name in the table you used as the source of the PivotTable, and an area identified by the heading, Drag Fields Between Areas Below, which is divided into four drop zones (Filters, Columns, Rows, and Values) at the bottom.

To complete the new PivotTable, you assign the fields in the PivotTable Fields task pane to the various areas of the PivotTable. You do this by dragging a field name from the Choose Fields to Add to Report list box to one of the four areas (or drop zones) in the Drag Fields Between Areas Below section at the bottom of the task pane:

- **Filters:** One or more fields that enable you to page through the data summaries shown in the PivotTable by filtering out sets of data — they act as the filters for the report. So, for example, if you designate the Year field from a table as a report filter, you can display data summaries in the PivotTable for individual years or for all years represented in the table. They appear at the top of the report above the columns and rows of the PivotTable.
- **Columns:** One or more fields that determine the arrangement of data shown in the columns of the PivotTable. Their entries appear in the PivotTable's column headings.

- **Rows:** One or more fields that determine the arrangement of data shown in the rows of the PivotTable. Their entries appear in the PivotTable's row headings.
- **Values:** One or more fields that determine the summary results that appear in the body of the PivotTable. They are the values that are totaled in the last row and column of the PivotTable.

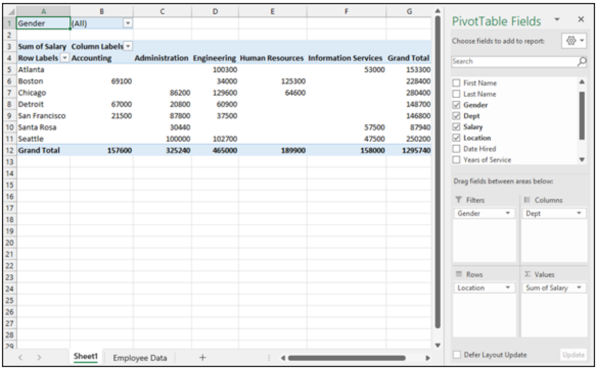
REMEMBER You can also add fields to the new PivotTable by selecting the check box in front of the field name. When you use this method to build your PivotTable, Excel places the fields as follows:

- If Excel identifies the field as text, it automatically adds the field to the Rows area.
- If Excel identifies the field as numeric, it automatically adds the field to the Values area.

To remove a field from the PivotTable, clear its check box in the PivotTable Fields task pane.

To better understand how you can use these various areas in a PivotTable, look at a completed PivotTable in Figure 2-6 (sample workbook: Employee Table.xlsx). For this PivotTable, I dragged these fields in the employee table to the following areas in the PivotTable Fields task pane:

- **Filters:** Uses the Gender field, which contains F (for female) or M (for male) to indicate the employee's gender.



Gender (All)

Sum of Salary	Column Labels					
Row Labels	Accounting	Administration	Engineering	Human Resources	Information Services	Grand Total
Atlanta			100300		53000	153300
Boston	69100		34000	125300		228400
Chicago		86200	129600	64600		280400
Detroit	67000	20800	60900			148700
San Francisco	21500	87800	37500			146800
Santa Rosa		30440			57500	87940
Seattle		100000	102700		47500	250200
Grand Total	157600	325240	465000	189900	158000	1295740

PivotTable Fields

Choose fields to add to report:

☐ First Name
☐ Last Name
☑ Gender
☑ Dept
☑ Salary
☑ Location
☐ Date Hired
☐ Years of Service

Drag fields between areas below:

Filters: Gender
Columns: Dept
Rows: Location
Values: Sum of Salary

☐ Defer Layout Update

FIGURE 2-6: A completed PivotTable after adding the fields from the employee table to its various sections. (Sample workbook: Employee Table.xlsx)

- **Columns:** Uses the Dept field, which contains the names of the various departments in the company (Accounting, Administration, and so on).
- **Rows:** Uses the Location field, which contains the names of the various cities with corporate offices (Atlanta, Boston, and so on).
- **Values:** Uses the Salary field, which contains the annual salary for each employee.

This PivotTable displays the sum of the salaries for both the men and women employees in each department (across the columns) and then presents these sums by their location (in each row).

When you create a new PivotTable (or select the cell of an existing PivotTable in a worksheet), Excel displays the PivotTable Analyze contextual tab. Among the many groups on this tab, you find the Active Field group, which contains the following useful command buttons:

- **Active Field:** Indicates the PivotTable field that's active in the worksheet.
- **Field Settings:** Opens the Field Settings dialog box, where you can change various settings for the PivotTable field that’s active in the worksheet.

REMEMBER

CUSTOMIZING THE PIVOTTABLE FIELDS TASK PANE DISPLAY

By default, Excel displays the list of fields stacked on top of the four areas — Filters, Columns, Rows, and Values — in the PivotTable Fields task pane. You can change this arrangement by clicking the Tools drop-down button (the gear icon to the right of the Choose Fields to Add to Report heading) and then choosing one of the following options from its drop-down menu:

- **Fields Section and Areas Section Stacked:** Displays the list of fields over the areas section (this is the default view).
- **Fields Section and Areas Section Side-by-Side:** Displays the list of fields in a column to the left of the areas section.
- **Fields Section Only:** Displays only the list of fields.
- **Areas Section Zones Only (2 by 2):** Displays only the areas section in two columns.
- **Areas Section Zones Only (1 by 4):** Displays only the areas section in one column.

When you display only the four areas in the PivotTable Fields task pane, you can click the drop-down buttons that appear to the right of the name of each field you add to the four areas to manipulate the fields: Move to Report Filter to move the field to the Filters area; Move to Row Labels to move the field to the Rows area; Move to Column Labels to move the field to the Columns area; or Move to Values to move the field to the Values area, Remove Field to remove the field from its current drop zone, or Field Settings to open the Fields Settings dialog box, where you can adjust the subtotals, filter, layout, and print settings for the field.

Formatting a PivotTable

Formatting a PivotTable is similar to formatting any other table or range. All you need to do is click a cell of the PivotTable to add the Design contextual tab to the Ribbon.

The Design contextual tab is divided into three groups:

- **Layout** group to add subtotals and grand totals to the PivotTable and modify its basic layout

- **PivotTable Style Options** group to refine the PivotTable style you select for the table using the PivotTable Styles gallery to the immediate right
- **PivotTable Styles** group containing the gallery of styles you can apply to the active PivotTable by clicking the desired style thumbnail

Refining the PivotTable layout and style

After selecting a style from the PivotTable Styles gallery on the Design contextual tab, you can then refine the style using the command buttons in the Layout group and the check boxes in the PivotTable Style Options group.

The Layout group on the Design tab contains the following four command buttons:

- **Subtotals:** Hide subtotals in the summary report or have them displayed at the top or bottom of their groups in the report.
- **Grand Totals:** Turn on or off the display of grand totals in the last row or column of the report.
- **Report Layout:** Modify the display of the report by selecting between the default Compact Form and the much more spread-out Outline Form (which connects the subtotals across the columns of the table with lines or shading depending on the table style selected) and Tabular Form (which connects the row items in the first column and the subtotals across the columns of the table with gridlines or shading depending on the table style selected)
- **Blank Rows:** Insert or remove a blank row after each item in the table

The PivotTable Style Options group contains the following four check boxes:

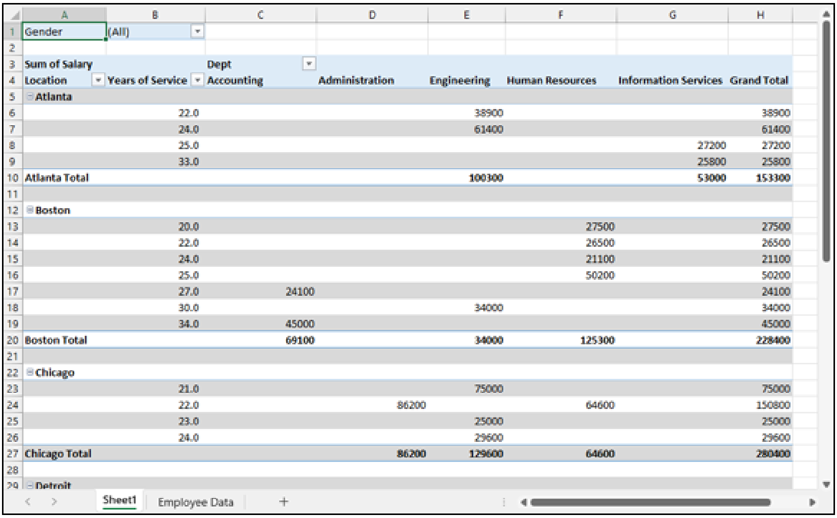
- **Row Headers:** Remove and then re-add the font and color formatting from the row headers of the table in the first column of the table applied by the currently selected PivotTable style
- **Column Headers:** Remove and then re-add the font and color formatting from the column headers at the top of the table applied by the currently selected PivotTable style
- **Banded Rows:** Add and remove banding in the form of gridlines

or shading (depending on the currently selected PivotTable style) from the rows of the PivotTable

- **Banded Columns:** Add and remove banding in the form of gridlines or shading (depending on the currently selected PivotTable style) from the columns of the PivotTable

Figure 2-7 (sample workbook: Employee Table.xlsx) shows the original PivotTable created from the employee table after making the following changes:

- Adding the Years of Service field as a second row field and then closing the PivotTable Fields task pane
- Selecting the Banded Rows check box in the PivotTable Style Options group on the Design contextual tab
- Choosing the Show in Outline Form option from the Report Layout command button's drop-down menu in the Layout group of the Design tab
- Choosing the Insert Blank Line after Each Item option from the Blank Rows command button's drop-down menu in the Layout group of the Design tab
- Choosing the Show All Subtotals as Bottom of Group option from the Subtotals command button's drop-down menu in the Layout group of the Design tab



	A	B	C	D	E	F	G	H
1	Gender	(All)						
2								
3	Sum of Salary		Dept					
4	Location	Years of Service	Accounting	Administration	Engineering	Human Resources	Information Services	Grand Total
5	Atlanta							
6		22.0			38900			38900
7		24.0			61400			61400
8		25.0					27200	27200
9		33.0					25800	25800
10	Atlanta Total				100300		53000	153300
11								
12	Boston							
13		20.0				27500		27500
14		22.0				26500		26500
15		24.0				21100		21100
16		25.0				50200		50200
17		27.0	24100					24100
18		30.0			34000			34000
19		34.0	45000					45000
20	Boston Total		69100		34000	125300		228400
21								
22	Chicago							
23		21.0			75000			75000
24		22.0		86200		64600		150800
25		23.0			25000			25000
26		24.0			29600			29600
27	Chicago Total			86200	129600	64600		280400
28								
29	Detroit							

FIGURE 2-7: The revised PivotTable in the Outline Form with an extra blank row between each

item. (Sample workbook: Employee Table.xlsx)

Formatting the parts of the PivotTable

Even after applying a style to your new PivotTable, you may still want to make some individual adjustments to its formatting, such as selecting a new font, font size, or cell alignment for the text of the table and a new number format for the values in the table’s data cells.

You can make these types of formatting changes to a PivotTable by selecting the part of the report to which the formatting is to be applied and then selecting the new formatting from the appropriate command buttons in the Home tab's Font, Alignment, and Number groups.

Applying a new font, font size, or alignment to the PivotTable

You can modify the text in a PivotTable by selecting a new font, font size, or horizontal alignment. To make these formatting changes to the text in the entire table, select the entire table before you use the appropriate command buttons in the Home tab's Font and Alignment groups. To apply these changes only to the headings in the PivotTable, select only its labels before using the commands on the Home tab. To apply these changes only to the data in the body of the PivotTable, select only its cells.

To help you select the cells you want to format in a PivotTable, use the following Select items on the Actions command button’s drop-down list:

1. **Click a cell in the PivotTable in the worksheet and then choose PivotTable Analyze ⇒ Select (or press Alt+JTW).**
2. **On the Select submenu, you can do the following:**
    - Click the Label and Values option to select the cells with the row and column headings and those with the values in the table.
    - Click the Values option to select only the cells with values in the table.
    - Click the Labels option to select only the cells with the rows and column headings in the table.
    - Click the Entire PivotTable option on the Select submenu to select all the PivotTable cells, including the Report Filter cells.

  - Click the Enable Selection option to be able to select single rows or columns of the PivotTable by clicking them with the mouse or Touch pointer.

REMEMBER You can also use the following hot keys to select all or part of your PivotTable:

- **Alt+JTWA** to select the label cells with the row and column headings as well as the data cells with the values in the body of the PivotTable
- **Alt+JTWV** to select only the data cells with the values in the body of the PivotTable
- **Alt+JTWL** to select only the label cells with the row and column headings in the PivotTable
- **Alt+JTWT** to select the entire table, that is, all the cells of the PivotTable including those with the Report Filter

REMEMBER You can use the Label and Values, Values, and Labels options on the Select button's drop-down menu and their hot key equivalents only *after* you have selected the Entire PivotTable option to select all the cells.

TIP Use Live Preview to preview the look of a new font or font size on the Font or Font Size drop-down menu in the Font group on the Ribbon's Home tab.

Applying a number format to the data cells

When you first create a PivotTable, Excel doesn't apply a number format to the cells in the Values area or to the subtotals and grand totals that Excel adds to the table. You can, however, assign any of the Excel number formats to the values in the PivotTable in one of two manners.

In the first method, you select the entire table (Alt+JTWT), select only its data cells in the body of the PivotTable (Alt+JTWV), and then apply the desired number format using the command buttons in the Number group of the Home tab of the Ribbon. For example, to format the data cells with the Accounting number format with no decimal places, you click the Accounting Number Format command button and then click the Decrease Decimal command button twice.

You can also apply a number format to the data cells in the body of the PivotTable by following these steps:

1. **Click the name of the field in the PivotTable that contains the words "Sum of" and then choose PivotTable Analyze ⇒ Field Settings to open the Summarize Values By tab of the Value Field Settings dialog box.**

   In my Employee example PivotTable, this field is called Sum of Salary because the Salary field is summarized. Note that this field is located at the intersection of the Column and Row Label fields in the table.

2. **Click the Number Format command button in the Value Field Settings dialog box to open the Number tab of the Format Cells dialog box.**
3. **Click the type of number format you want to assign to the values in the PivotTable on the Category list box of the Number tab.**
4. **(Optional) Modify any other options for the selected number format such as Decimal Places, Symbol, and Negative Numbers that are available for that format.**
5. **Click OK twice — the first time to close the Format Cells dialog box and the second to close the Value Field Settings dialog box.**

Sorting and Filtering the PivotTable Data

When you create a new PivotTable, you'll notice that Excel automatically adds AutoFilter buttons to the Report Filter field as well as the labels for the Column and Row fields. These AutoFilter buttons enable you to filter out all but certain entries in any of these fields, and in the case of the Column and Row fields, to sort their entries in the table.

When you add more than one Column or Row field to your PivotTable, Excel adds collapse buttons (–) that you can use to temporarily hide subtotal values for a particular secondary field. After clicking a collapse button in the table, it immediately becomes an expand button (+) that you can click to redisplay the subtotals for that one secondary field.

Filtering the report

Perhaps the most important AutoFilter buttons in a PivotTable are the ones added to the Report Filter field(s). By selecting a particular option on the drop-down lists attached to one of these AutoFilter buttons, only the summary data for that subset you select is then displayed in the PivotTable itself.

For example, in the example PivotTable (refer to Figure 2-6) that uses the Gender field from the employee table as the Report Filter field, you can display the sum of just the women's salaries by location and department in the body of the PivotTable by clicking the Gender field's filter button, selecting F from the drop-down list, and then clicking OK.

Excel then displays F in the Gender Report Filter field instead of the default (All) and replaces the standard drop-down button icon with a cone-shaped filter icon, indicating that the field is currently being filtered to show only some of the values in the data source.

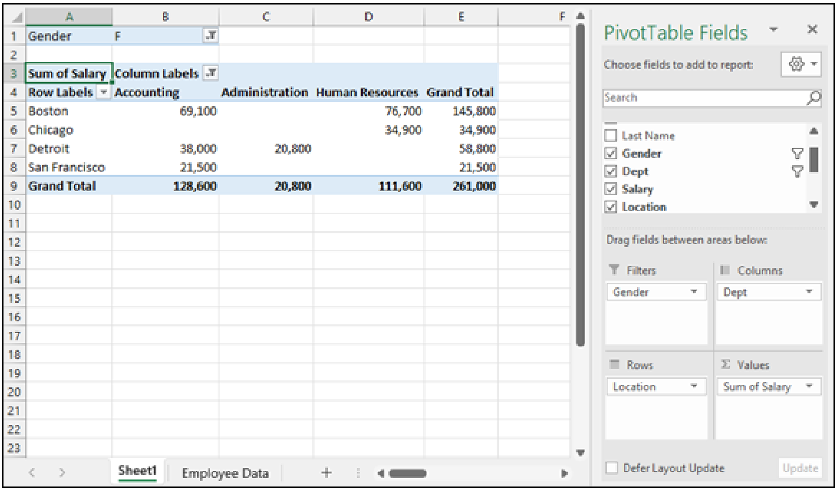
Likewise, you can view the summary of the men's salaries by selecting M from this filter button's drop-down list. To later redisplay the summary of the salaries for all the employees, select the (All) option from this list and then click OK.

Filtering individual Column and Row fields

The AutoFilter buttons on the Column and Row fields enable you to filter particular groups and, in some cases, individual entries in the data source. To filter the summary data in the columns or rows of a PivotTable, click the Column or Row field's filter button and start by deselecting the check box for the (Select All) option at the top of the drop-down list to clear its check mark. Select the check boxes for all the groups or individual entries whose summed values you still want displayed in the PivotTable, and then click OK.

As when filtering a Report Filter field in the table, Excel replaces the standard drop-down button icon displayed in the particular Column or Report field with a cone-shaped filter icon. This icon indicates that the field is currently being filtered and only some of its summary values are now displayed in the PivotTable. To redisplay all the values for a filtered Column or Report field, you need to click its filter button, click the (Select All) option at the top of its drop-down list, and then click OK.

Figure 2-8 (sample workbook: Employee Table.xlsx) shows the original sample PivotTable after formatting the values (with a number format that uses a comma as a thousands separator and displays zero decimal places) and then filtering its Gender Filter Report Field to women by selecting F (for Female) and its Dept Column Field to Accounting, Administration, and Human Resources.



	A	B	C	D	E
1	Gender	F			
2					
3	Sum of Salary	Column Labels			
4	Row Labels	Accounting	Administration	Human Resources	Grand Total
5	Boston	69,100		76,700	145,800
6	Chicago			34,900	34,900
7	Detroit	38,000	20,800		58,800
8	San Francisco	21,500			21,500
9	Grand Total	128,600	20,800	111,600	261,000

PivotTable Fields

Choose fields to add to report:

☐ Last Name
☑ Gender
☑ Dept
☑ Salary
☑ Location

Drag fields between areas below:

Filters: Gender
Columns: Dept
Rows: Location
Values: Sum of Salary

☐ Defer Layout Update

FIGURE 2-8: The PivotTable after filtering the Gender Filter Report field and the Dept Column field. (Sample workbook: Employee Table.xlsx)

TIP

Notice in Figure 2-8 that after filtering the PivotTable by selecting F in the Gender Filter Report field and selecting Accounting, Administration, and Human Resources departments as the only Dept Column fields, the filtered PivotTable no longer displays salary summaries for all the company's locations. (Santa Rosa, Seattle, and Atlanta locations are missing.) The table is missing these locations because there are no women employees in the three selected departments and not as a result of filtering the Location Row Labels field because its drop-down button still uses the standard icon and not the cone filter icon now shown to the right of the Gender Filter Report and Dept Column Labels fields.

Slicing the PivotTable data

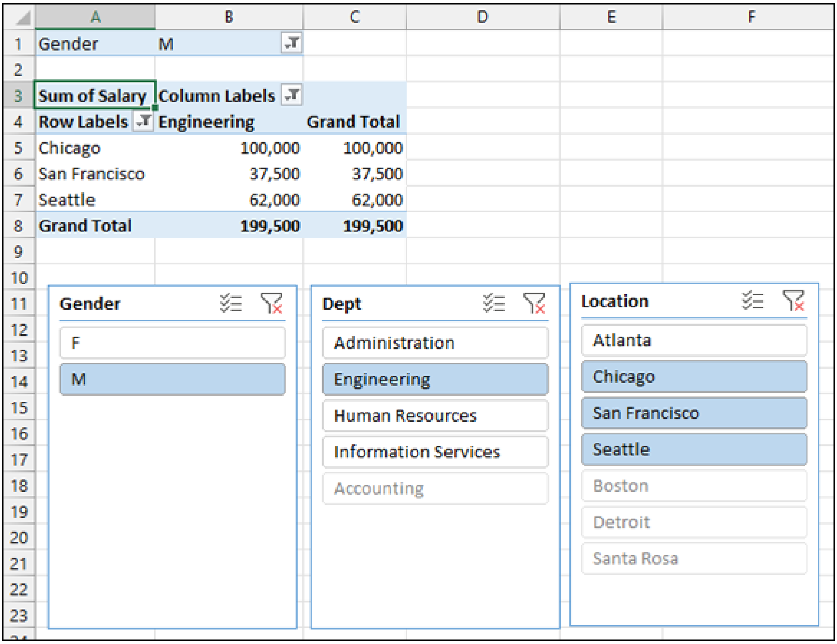
Excel supports *slicers,* a graphic tool for filtering the data in your PivotTable. Instead of having to filter the data using the check boxes attached to an item list on the drop-down menus on a field's AutoFilter button, you can use slicers instead. Slicers, which float as graphic objects over the worksheet, not only enable you to quickly filter the data in particular fields of a PivotTable, but also enable you to connect slicers to multiple PivotTables or to a PivotTable and a PivotChart you've created.

To use slicers on a PivotTable, click one of the table's cells and then choose PivotTable Analyze ⇒ Insert Slicer (or press Alt + JTSF). Excel displays the Insert Slicers dialog box containing a list of all the fields in the current PivotTable. Select the check boxes for all the fields you want to filter the PivotTable, and then click OK.

Excel displays a slicer for each field you select in the Insert Slicers dialog box. Each slicer appears as a rectangular graphic object that contains buttons for each entry in that PivotTable field. You can then filter the data in the PivotTable by clicking the individual entries in the slicer for all the values you still want displayed in the table. To display values for multiple entries in a particular field, either click the Multi-Select icon (the checklist icon to the right of the field name) or hold down the Ctrl key as you select the entries in the slicer. To display multiple consecutive values, click the first entry in its slicer, hold the Shift key, and then click the last entry you want included.

Figure 2-9 (sample workbook: Employee Table.xlsx) shows you the PivotTable for the employee table after I used three slicers to filter it. The first slicer is for the Gender field, where I selected M so that only the records for the men are displayed in the PivotTable. The second slicer is for the Dept field, where I clicked the Engineering item to display only the men's salaries in Engineering. The third and final slicer is for the Location field, where I selected the Chicago, San Francisco, and Seattle locations (by holding down Ctrl as I clicked their buttons in the Location slicer). As a result, the employee data PivotTable is now filtered so that you see only the salary totals for the men in the

Engineering departments at the Chicago, San Francisco, and Seattle offices.



Gender	M	
Sum of Salary	Column Labels	
Row Labels	Engineering	Grand Total
Chicago	100,000	100,000
San Francisco	37,500	37,500
Seattle	62,000	62,000
Grand Total	**199,500**	**199,500**

A
B
C
D
E
F
Gender
F
M
Dept
Administration
Engineering
Human Resources
Information Services
Accounting
Location
Atlanta
Chicago
San Francisco
Seattle
Boston
Detroit
Santa Rosa

FIGURE 2-9: Employee PivotTable showing the men's salaries in the Engineering department in Chicago, San Francisco, and Seattle. (Sample workbook: Employee Table.xlsx)

REMEMBER Because slicers are graphic objects, when you add them to your worksheet, the program automatically adds a Slicer contextual tab to the Ribbon. This Slicer tab contains many of the same graphic controls that you're used to when dealing with standard graphic objects such as shapes and text boxes, including a Slicer Styles drop-down gallery and Bring Forward, Send Back, and Selection Pane buttons that you can use to format the currently selected slicer. You can also use the Height and Width options in the Buttons and Size groups to modify the dimensions of the slicer and the buttons it contains. Finally, you can use the Report Connections command button to open the Report Connections dialog box, where you can connect additional PivotTables to the currently selected slicer.

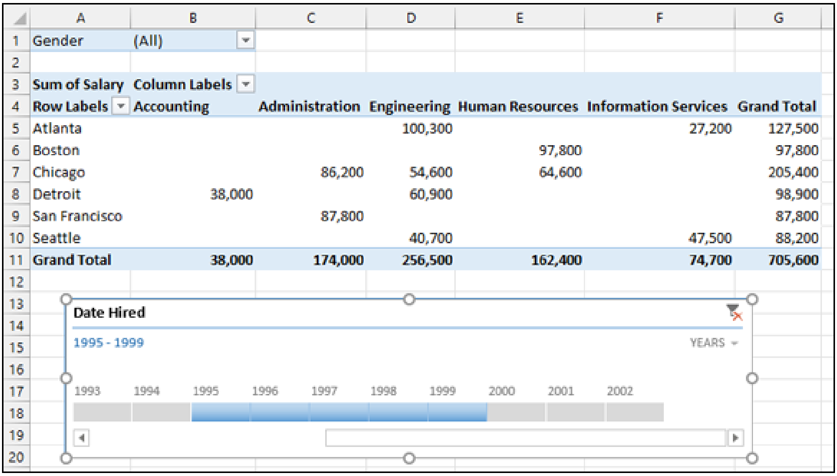
To move a slicer, you click it to select it and then drag it from somewhere on its border using the black-cross pointer with an arrowhead. To deselect the items you've selected in a slicer, click the button in the upper-right corner of the slicer with a red *x* through the filter icon. To get rid of a slicer (and automatically redisplay the PivotTable Fields task pane), select the slicer and then press the Delete key.

Using timeline filters

Excel also enables you to filter your data with its timeline feature. You can think of timelines as slicers designed specifically for date fields that enable you to filter data out of your PivotTable that doesn't fall within a particular period, thereby allowing you to see timing of trends in your data.

To create a timeline for your PivotTable, select a cell in your PivotTable and then choose PivotTable Analyze ⇒ Insert Timeline. Excel displays the Insert Timelines dialog box displaying a list of PivotTable fields that you can use in creating the new timeline. After selecting the check box for the date field you want to use in this dialog box, click OK.

Figure 2-10 (sample workbook: Employee Table.xlsx) shows you the timeline I created for the sample Employee Table by selecting its Date Hired field in the Insert Timelines dialog box. As you can see, Excel created a floating Date Hired timeline with the years and months demarcated and a bar that indicates the time period selected. By default, the timeline uses months as its units, but you can change this to years, quarters, or even days by clicking the time units' drop-down button immediately below the filter icon in the upper-right corner of the timeline and then selecting the desired time unit.



Gender (All)

Sum of Salary	Column Labels					
Row Labels	Accounting	Administration	Engineering	Human Resources	Information Services	Grand Total
Atlanta			100,300		27,200	127,500
Boston				97,800		97,800
Chicago		86,200	54,600	64,600		205,400
Detroit	38,000		60,900			98,900
San Francisco		87,800				87,800
Seattle			40,700		47,500	88,200
Grand Total	38,000	174,000	256,500	162,400	74,700	705,600

FIGURE 2-10: Employee PivotTable using a timeline filter to show the salaries for employees hired during the period 1995 through 1999. (Sample workbook: Employee Table.xlsx)

For Figure 2-10, I selected the Years option as the timeline's unit and then selected the period 1995 through 1999 so that the PivotTable shows the salaries by department and location for only employees hired during this four-year period. I did this by dragging the timeline bar in the Date Hired timeline graphic so that it begins at 1995 and extends just up to 2000. And should I need to filter the PivotTable salary data for other hiring periods, I would modify the start and stop times by dragging the timeline bar in the Date Hired timeline.

Sorting the PivotTable

You can instantly reorder the summary values in a PivotTable by sorting the table on one or more of its Column or Row fields. To re-sort a PivotTable, click the AutoFilter button for the Column or Row field you want to use in the sort and then click either the Sort A to Z option or the Sort Z to A option at the top of the field's drop-down list.

Click the Sort A to Z option when you want the table reordered by sorting the labels in the selected field alphabetically, or, in the case of values, from the smallest to largest value, or, in the case of dates, from the oldest to newest date. Click the Sort Z to A option when you want the table reordered by sorting the labels in reverse alphabetical order (Z to A), values from the highest to smallest, and dates from the newest to oldest.

Modifying the PivotTable

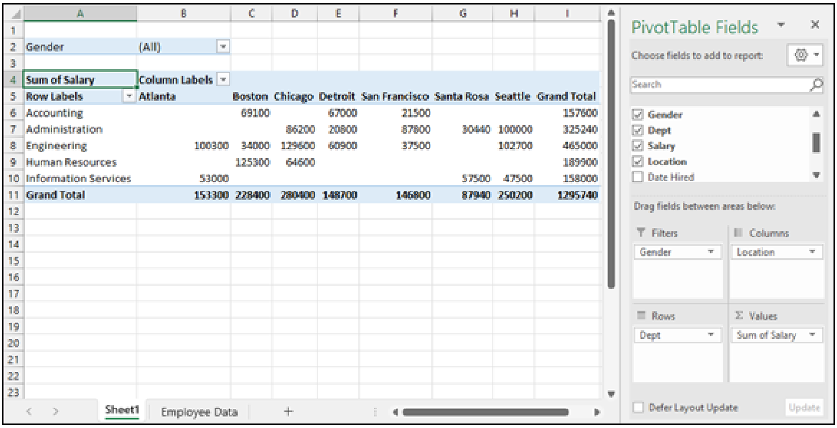
As the term *pivot* implies, the fun of PivotTables is being able to rotate the data fields by using the rows and columns of the table, as well as to change what fields are used on the fly. For example, suppose that after making the table's Location field the PivotTable's Rows Labels Field, and its Dept field the Columns Labels Field, you now want to see what the table looks like with the Dept field as the Rows Labels Field and the Location field as the Columns Labels Field.

No problem: All you have to do is open the PivotTable Fields task pane (Alt + JTL) and then drag Location from the Rows area to the Columns area and then drag Dept from the Columns to Rows. *Voilà* — Excel rearranges the totaled salaries so that the rows of the PivotTable show the location grand totals, and the columns now show the departmental grand totals. Figure 2-11 (sample workbook: Employee Table.xlsx) shows this new arrangement for the PivotTable.

In fact, when pivoting a PivotTable, not only can you rotate existing fields, but you can also add new fields to the PivotTable or assign more fields to the table's Columns and Rows areas.

Figure 2-12 (sample workbook: Employee Table.xlsx) illustrates this situation. This figure shows the same PivotTable after making a couple of key changes to the table structure. First, I added the Profit Sharing field as a second Report Filter field by dragging it to the Filters area in the PivotTable Fields task pane. Then, I made Location a second Row Labels Field by dragging it from the Columns area to the Rows area. Finally, for this figure, I changed the setting in the Gender Report Filter from the default of All to M and changed the Profit Sharing Report Filter to Yes.

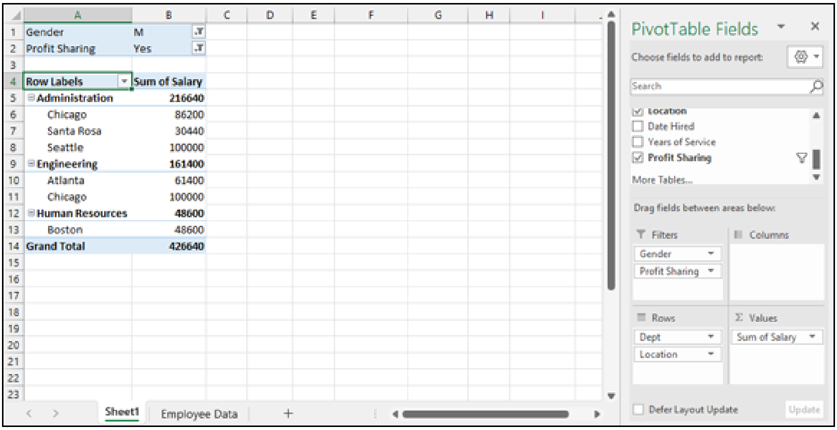
As a result, the modified PivotTable shown in Figure 2-12 now shows the salary totals for all the men in the corporation arranged first by their department and then by their location. Because I added Profit Sharing as a second Report Filter, I can see the totals for just the men or just the women who are or aren't currently enrolled in the profit sharing plan by selecting the appropriate Report Filter settings.



Gender	(All)							
Sum of Salary	**Column Labels**							
Row Labels	**Atlanta**	**Boston**	**Chicago**	**Detroit**	**San Francisco**	**Santa Rosa**	**Seattle**	**Grand Total**
Accounting		69100		67000	21500			157600
Administration			86200	20800	87800	30440	100000	325240
Engineering	100300	34000	129600	60900	37500		102700	465000
Human Resources		125300	64600					189900
Information Services	53000					57500	47500	158000
Grand Total	153300	228400	280400	148700	146800	87940	250200	1295740

PivotTable Fields
Choose fields to add to report:
Search
☑ Gender
☑ Dept
☑ Salary
☑ Location
☐ Date Hired
Drag fields between areas below:
Filters
Gender
Columns
Location
Rows
Dept
Values
Sum of Salary
☐ Defer Layout Update
Update
Sheet1
Employee Data

FIGURE 2-11: Pivoting the table so that Dept is now the Column Labels Field and Location the Row Labels Field. (Sample workbook: Employee Table.xlsx)



Gender	M
Profit Sharing	Yes
Row Labels	**Sum of Salary**
⊟ Administration	**216640**
Chicago	86200
Santa Rosa	30440
Seattle	100000
⊟ Engineering	**161400**
Atlanta	61400
Chicago	100000
⊟ Human Resources	**48600**
Boston	48600
Grand Total	**426640**

PivotTable Fields
Choose fields to add to report:
Search
☑ Location
☐ Date Hired
☐ Years of Service
☑ Profit Sharing
More Tables...
Drag fields between areas below:
Filters
Gender
Profit Sharing
Columns
Rows
Dept
Location
Values
Sum of Salary
☐ Defer Layout Update
Update
Sheet1
Employee Data

FIGURE 2-12: The PivotTable after adding Profit Sharing as another Report Filter and making both the Dept and Location Row Fields. (Sample workbook: Employee Table.xlsx)

Changing the summary functions

By default, Excel uses the good old SUM function to total the values in the numeric field(s) that you add to the Values area, thereby assigning them to the data cells in the body of the PivotTable. Some data summaries require the use of another summary function, such as the AVERAGE or COUNT function.

To change the summary function that Excel uses, you open the Field Settings dialog box for one of the fields that you use as the data items in the PivotTable. You can do this either by clicking the Value Field Settings option on the field's drop-down menu in the Values area in the

PivotTable Fields task pane (Alt + JTL) or by right-clicking the field's label and then selecting Value Field Settings on its shortcut menu.

After you open the Value Field Settings dialog box for the field, you can change its summary function from the default Sum to any of the following functions by selecting it on the Summarize By tab:

- **Count:** to show the count of the records for a particular category (note that COUNT is the default setting for any text fields that you use as Data Items in a PivotTable).
- **Average:** Calculates the average (that is, the arithmetic mean) for the values in the field for the current category and page filter.
- **Max:** Calculates the largest numeric value in that field for the current category and page filter.
- **Min:** Calculates the smallest numeric value in that field for the current category and page filter.
- **Product:** Calculates the product of the numeric values in that field for the current category and page filter (all nonnumeric entries are ignored).
- **Count Numbers:** Calculates the number of numeric values in that field for the current category and page filter (all nonnumeric entries are ignored).
- **StdDev:** Calculates the standard deviation for the sample in that field for the current category and page filter.
- **StdDevp:** Calculates the standard deviation for the population in that field for the current category and page filter.
- **Var:** Calculates the variance for the sample in that field for the current category and page filter.
- **Varp:** Calculates the variance for the population in that field for the current category and page filter.

After you select the new summary function to use on the Summarize By tab of the Value Field Settings dialog box, click OK to apply the new function to the data presented in the body of the PivotTable.

Adding Calculated Fields

Besides using various summary functions on the data presented in your PivotTable, you can create your own Calculated Fields for the PivotTable. Calculated Fields are computed by a formula that you create by using existing numeric fields in the data source. To create a Calculated Field for your PivotTable, follow these steps:

1. **Click any of the cells in the PivotTable and then choose PivotTable Analyze ⇒ Fields, Items, & Sets ⇒ Calculated Field (or press Alt + JTJF).**

   The Fields, Items, & Sets command button is found in the Calculations group on the PivotTable Analyze contextual tab.

   Excel opens the Insert Calculated Field dialog box similar to the one shown in Figure 2-13.

2. **Enter the name for the new field in the Name text box.**

3. **Click the Formula text box and then delete the zero (0) after the equal sign and position the insertion point immediately following the equal sign (=).**

4. **Enter the formula to perform the new field's calculation in the Formula text box, inserting whatever fields you need by clicking the name in the Fields list box and then clicking the Insert Field button.**

   To do this, insert numeric fields from the Fields list box and indicate the operation to perform on them with the appropriate arithmetic operators (+, -, *, or /).

   For example, in Figure 2-13, I created a formula for the new calculated field called Bonus that multiplies the values in the Salary Field by 2.5 percent (0.025) to compute the total amount of annual bonuses to be paid. To do this, I selected the Salary field in the Fields list box and then clicked the Insert Field button to add Salary to the formula in the Formula text box (as in =Salary). Then, I typed *0.025 to complete the formula (=Salary*0.025).

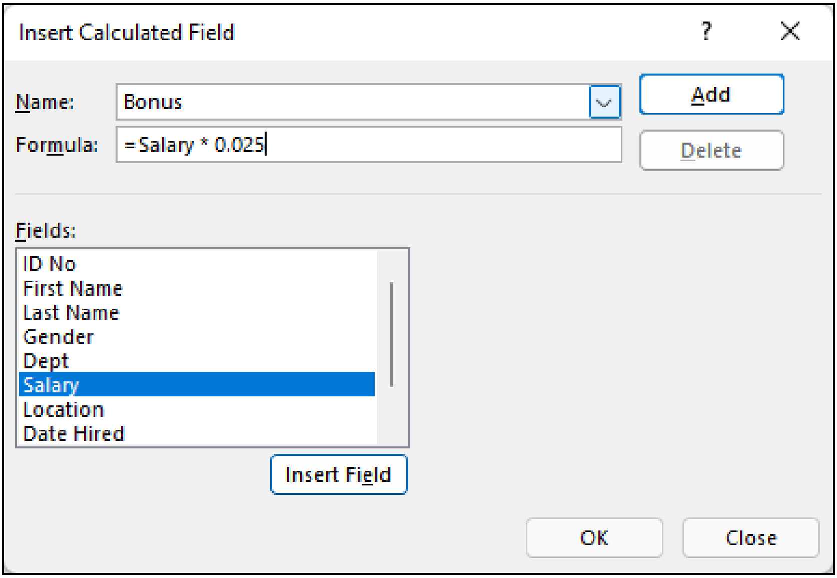
5. **When you finish entering the formula for your**

calculated field, you can add the calculated field to the PivotTable Fields task pane by clicking the Add button.

After you click the Add button, it changes to a grayed-out Modify button. If you start editing the formula in the Formula text box, the Modify button becomes active so that you can click it to update the definition.

6. **Click OK in the Insert Calculated Field dialog box.**

   The Insert Calculated Field dialog box closes and adds the summary of the data in the calculated field to your PivotTable.



Name: Bonus

Formula: =Salary * 0.025

Insert Calculated Field
?
X
Add
Delete
Fields:
ID No
First Name
Last Name
Gender
Dept
Salary
Location
Date Hired
Insert Field
OK
Close

FIGURE 2-13: Creating a calculated field for a PivotTable.

After you finish defining a calculated field to a PivotTable, Excel automatically adds its name to the field list in the PivotTable Fields task pane and to the Values area, thereby assigning the calculated field as another Data item in the body of the PivotTable.

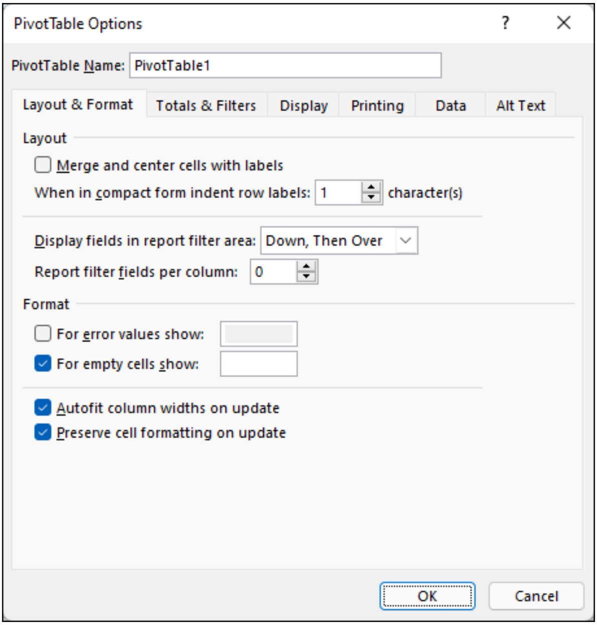
REMEMBER If you want to temporarily hide a calculated field from the body of the PivotTable, deselect the name of the calculated field in the field list in the PivotTable Fields task pane (Alt + JTL). Then, when you're ready to redisplay the calculated field, you can do so by selecting its check box in the field list in the PivotTable Fields task pane again.

Changing the PivotTable options

You can use the PivotTable Options dialog box (shown in Figure 2-14) to change the settings applied to the PivotTables that you create in a workbook. You open this dialog box by choosing PivotTable Analyze ⇒ Options (or by pressing Alt + JTTT).

The PivotTable Options dialog box contains the following six tabs:

- **Layout & Format:** Options for controlling the various aspects of the layout and formatting of the cells in the PivotTable
- **Totals & Filters:** Options for controlling the display of the subtotals and grand totals in the report, and filtering and sorting the table's fields
- **Display:** Options for controlling the display items in the table and the sorting of the fields in the PivotTable
- **Printing:** Options for controlling print expand and collapse buttons when displayed in the PivotTable, and print titles with the row and column labels on each page of the printout



PivotTable Name: PivotTable1

Layout

☐ Merge and center cells with labels

When in compact form indent row labels: 1 character(s)

Display fields in report filter area: Down, Then Over

Report filter fields per column: 0

Format

☐ For error values show:

☑ For empty cells show:

☑ Autofit column widths on update

☑ Preserve cell formatting on update

FIGURE 2-14: Modifying the PivotTable options in the PivotTable Options dialog box.

- **Data:** Options for controlling how the data that supports the PivotTable is stored and refreshed
- **Alt Text:** Options for adding alternate, text-based titles and descriptions of the information in the PivotTable for those with vision impairments who then hear the title and description read aloud

TIP

Perhaps the most important PivotTable option is the Classic PivotTable Layout (Enables Dragging of Fields in the Grid) check box option on the Display tab. When you select this check box, Excel lets you rearrange the fields within the PivotTable by dragging their icons onto the desired part of the table (Table Filter, Column Labels, or Row Labels). The program also lets you add fields to the PivotTable by dragging them from the field list in the PivotTable Fields task pane and dropping them on the part of the table to which they are to be added.

Creating PivotCharts

Instead of generating just a PivotTable, you can spice up your data summaries by generating a PivotChart to go along with a supporting PivotTable. To create a PivotChart from your PivotTable, follow these two steps:

1. **Select a cell in the PivotTable and then choose PivotTable Analyze ⇒ PivotChart (or press Alt + JTC).**

   Excel opens the Insert Chart dialog box where you can select the type and subtype of the PivotChart you want to create. (See Book 5, Chapter 1.)

2. **Click the thumbnail of the subtype of chart you want to create in the Insert Chart dialog box and then click OK.**

Excel inserts an embedded PivotChart into the worksheet containing the original PivotTable. This new PivotChart contains drop-down buttons for each of the four different types of fields used in the PivotChart (Report Filter, Legend Fields, Axis Fields, and Values). You can use these drop-down buttons to sort and filter the data represented in the chart. (See "Filtering a PivotChart" later in this chapter for details.)

When the PivotChart is selected, Excel augments the Ribbon with three contextual tabs: PivotChart Analyze, Design, and Format, which is automatically selected.

Moving a PivotChart to its own sheet

Although Excel automatically creates all new PivotCharts on the same worksheet as the PivotTable, you may find customizing and working with the PivotChart easier if you move the chart to its own chart sheet in the workbook. To move a new PivotChart to its own chart sheet in the workbook, follow these steps:

1. **Choose PivotChart Analyze ⇒ Move Chart (or press Alt + JTV).**

   Excel opens the Move Chart dialog box.

2. **Click the New Sheet option button in the Move Chart dialog box.**

3. **(Optional) Rename the generic Chart1 sheet name in the accompanying text box by entering a more descriptive name there.**
4. **Click OK to close the Move Chart dialog box and open the new chart sheet with your PivotChart.**

Figure 2-15 (sample workbook: Employee Table.xlsx) shows a clustered column PivotChart after moving the chart to its own chart sheet in the workbook.

Filtering a PivotChart

When you graph the data in a PivotTable using a typical chart type such as column, bar, or line that uses both an *x*- and *y*-axis, the Row labels in the PivotTable appear along the *x*- or category-axis at the bottom of the chart and the Column labels in the PivotTable become the data series that are delineated in the chart's legend. The numbers in the Values field are represented on the *y*- or value-axis that goes up the left side of the chart.

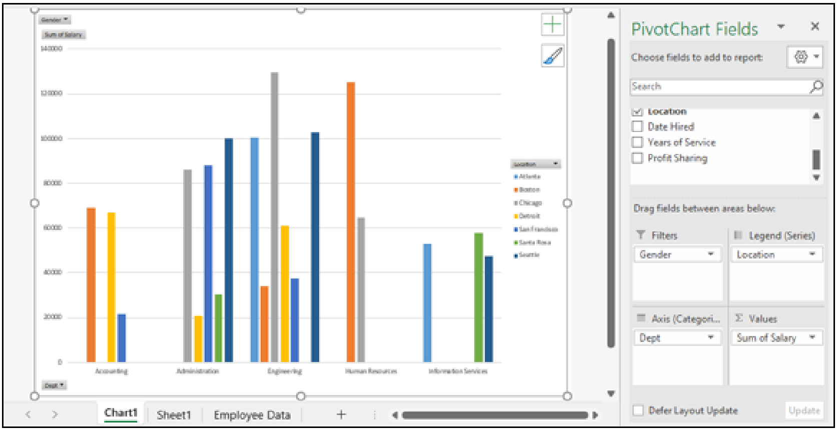

Gender
Sum of Salary
140000
120000
100000
80000
60000
40000
20000
0
Accounting
Administration
Engineering
Human Resources
Information Services
Dept
Location
Atlanta
Boston
Chicago
Detroit
San Francisco
Santa Rosa
Seattle
Chart1
Sheet1
Employee Data
+
PivotChart Fields
Choose fields to add to report:
Search
☑ Location
☐ Date Hired
☐ Years of Service
☐ Profit Sharing
Drag fields between areas below:
Filters
Legend (Series)
Gender
Location
Axis (Categori...
Values
Dept
Sum of Salary
☐ Defer Layout Update
Update

FIGURE 2-15: Clustered column PivotChart moved to its own PivotChart sheet. (Sample workbook: Employee Table.xlsx)

When you generate a new PivotChart, Excel adds drop-down list buttons to each of the types of fields represented. You can then use these drop-down buttons in the PivotChart itself to filter the charted data represented in this fashion like you do the values in the PivotTable. Remove the check mark from the (Select All) or (All) option and then add a check mark to each of the fields you still want represented in the filtered PivotChart.

Click the following drop-down buttons to filter a different part of the PivotChart:

- **Report Filter:** Filter which data series are represented in the PivotChart
- **Axis Fields (Categories):** Filter the categories that are charted along the *x*-axis at the bottom of the chart
- **Legend Fields (Series):** Filter the data series shown in columns, bars, or lines in the chart body and identified by the chart's legend

Formatting a PivotChart

When a PivotChart is active, the buttons on the Design and Format contextual tabs make it easy to further format and customize your PivotChart. Use the Design tab buttons to select a new chart style for your PivotChart or even a brand-new chart type and further refine your PivotChart by adding chart titles, text boxes, and gridlines. Use the Format tab's buttons to refine the look of any graphics you've added to the chart as well as select a new background color for your chart.

REMEMBER To get specific information on using the buttons on these tabs, see Book 5, Chapter 1, which covers creating charts from regular worksheet data. The Chart Design and Format contextual tabs that appear when you select a chart contain buttons that are comparable to those on an active PivotChart's Design and Format contextual tabs.

Using the Power Pivot Add-in

The Power Pivot add-in, which enables you to efficiently work with and analyze large datasets (such as those with hundreds of thousands or even millions of records), has been made a much more integral part of Excel. In fact, the Power Pivot technology that makes it possible for Excel to easily manage massive amounts of data from many related data tables is now part and parcel of Excel in the form of its Data Model feature. This means that you don't even have to trot out and use the Power Pivot add-in to be able to create Excel PivotTables that utilize tons of data records stored in multiple, related data tables. (See Book 6, Chapter 2 for details.)

If you do decide that you want to use Power Pivot in managing large datasets and doing advanced data modeling in your Excel PivotTables, instead of having to download the add-in from the Microsoft Office website, you can start using Power Pivot by activating the add-in as follows:

1. **Choose File ⇒ Options ⇒ Add-Ins or press Alt+FTAA.**

   Excel opens the Add-Ins tab of the Excel Options dialog box with Excel Add-Ins selected in the Manage drop-down list.

2. **Click the Manage drop-down list button and then select COM Add-Ins from the drop-down list before you select the Go button.**

   Excel displays the COM Add-Ins dialog box that contains (as of this writing) the following COM (Component Object Model) add-ins: Microsoft Data Streamer for Excel, Microsoft Power Map for Excel, and Microsoft Power Pivot for Excel.

3. **Select the Microsoft Office Power Pivot for Excel check box and then click OK.**

   Excel closes the COM Add-Ins dialog box and returns you to the Excel worksheet window that now contains a Power Pivot tab at the end of the Ribbon.

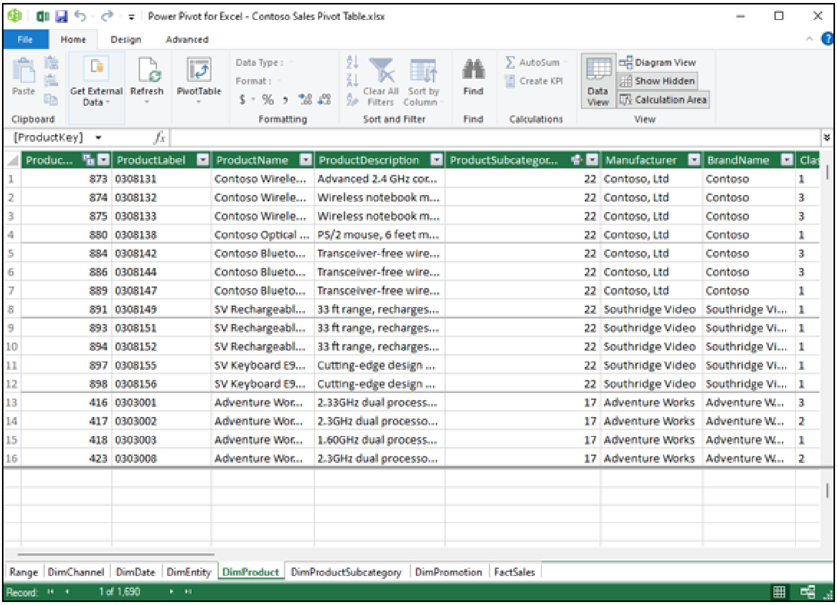
TIP

If the Power Pivot tab doesn't appear at the end of the Excel Ribbon, open the Customize Ribbon tab of the Options dialog box (Alt+FTC). Chances are that the Power Pivot check box under the Main tabs list box on the right-hand side is not checked, and all you have to do is select this check box. After you do this and click OK to close the Options dialog box, you should see the Power Pivot tab immediately to the right of the Help tab on the Ribbon.

Data modeling with Power Pivot

Power Pivot makes it easy to perform sophisticated modeling with the data in your Excel PivotTables. To open the Power Pivot for Excel window, choose Power Pivot ⇒ Manage.

If your workbook already contains a PivotTable that uses a Data Model created with external data already imported in the worksheet (see Book 6, Chapter 2 for details) when you click the Manage button, Excel opens a Power Pivot for Excel window similar to the one shown in Figure 2-16 (sample workbook: Contoso Sales PivotTable.xlsx). This window contains tabs at the bottom for all the data tables that you imported for use in the PivotTable. You can then review, filter, and sort the records in the data in these tables by selecting their respective tabs followed by the appropriate AutoFilter or Sort command button. (See Book 6, Chapter 1 for details.)


Power Pivot for Excel - Contoso Sales Pivot Table.xlsx
File
Home
Design
Advanced
Paste
Get External Data
Refresh
PivotTable
Data Type :
Format :
$ %
Clear All Filters
Sort by Column
Find
AutoSum
Create KPI
Data View
Diagram View
Show Hidden
Calculation Area
Clipboard
Formatting
Sort and Filter
Find
Calculations
View
[ProductKey]
Range
DimChannel
DimDate
DimEntity
DimProduct
DimProductSubcategory
DimPromotion
FactSales
Record:
1 of 1,690

	Produc...	ProductLabel	ProductName	ProductDescription	ProductSubcategor...	Manufacturer	BrandName	Cla
1	873	0308131	Contoso Wirele...	Advanced 2.4 GHz cor...	22	Contoso, Ltd	Contoso	1
2	874	0308132	Contoso Wirele...	Wireless notebook m...	22	Contoso, Ltd	Contoso	3
3	875	0308133	Contoso Wirele...	Wireless notebook m...	22	Contoso, Ltd	Contoso	3
4	880	0308138	Contoso Optical ...	PS/2 mouse, 6 feet m...	22	Contoso, Ltd	Contoso	1
5	884	0308142	Contoso Blueto...	Transceiver-free wire...	22	Contoso, Ltd	Contoso	3
6	886	0308144	Contoso Blueto...	Transceiver-free wire...	22	Contoso, Ltd	Contoso	3
7	889	0308147	Contoso Blueto...	Transceiver-free wire...	22	Contoso, Ltd	Contoso	1
8	891	0308149	SV Rechargeabl...	33 ft range, recharges...	22	Southridge Video	Southridge Vi...	1
9	893	0308151	SV Rechargeabl...	33 ft range, recharges...	22	Southridge Video	Southridge Vi...	1
10	894	0308152	SV Rechargeabl...	33 ft range, recharges...	22	Southridge Video	Southridge Vi...	1
11	897	0308155	SV Keyboard E9...	Cutting-edge design ...	22	Southridge Video	Southridge Vi...	1
12	898	0308156	SV Keyboard E9...	Cutting-edge design ...	22	Southridge Video	Southridge Vi...	1
13	416	0303001	Adventure Wor...	2.33GHz dual process...	17	Adventure Works	Adventure W...	3
14	417	0303002	Adventure Wor...	2.3GHz dual processo...	17	Adventure Works	Adventure W...	2
15	418	0303003	Adventure Wor...	1.60GHz dual process...	17	Adventure Works	Adventure W...	1
16	423	0303008	Adventure Wor...	2.3GHz dual processo...	17	Adventure Works	Adventure W...	2

FIGURE 2-16: The Power Pivot window with tabs for all the data tables imported into Excel when creating the workbook's PivotTable. (Sample workbook: Contoso Sales PivotTable.xlsx)

If you open the Power Pivot for Excel window before importing the external data and creating your PivotTable in the current Excel workbook, the Power Pivot window is empty of everything except the Ribbon with its three tabs: Home, Design, and Advanced. You can then use the From Database, From Data Service, or From Other Services buttons in the Get External Data group on the Home tab to import the data tables that make your Data Model:

- **From Database** to import data tables from a SQL Server, Access, or Analysis Services database to which you have access
- **From Data Service** to import data tables from a database via an OData (Open Data) Feed to which you have access
- **From Other Sources** to open the Table Import Wizard that enables you to import data tables from databases saved in a wide variety of popular database file formats, including Microsoft SQL Azure, Oracle, Teradata, Sybase, Informx, and IBM DB2, as well as data saved in flat files, such as another Excel workbook file or even a text file
- **Existing Connections** to import the data tables specified by a data query that you've already set up with an existing connection to an external data source (see Book 6, Chapter 2 for details)

After you select the source of your external data using one of the command button options available from the Power Pivot window in the Get External Data group, Excel opens a Table Import Wizard with options appropriate for defining the database file or server (or both) that contains the tables you want imported. Be aware that, when creating a connection to import data from most external sources (except for other Excel workbooks and text files), you're required to provide both a recognized username and password.

TIP If you don't have a username and password but know you have access to the database containing the data you want to use in your new PivotTable, import the tables and create the PivotTable in the Excel window using the Get Data button's drop-down menu found on the Data tab of its Ribbon and then open the Power Pivot window to use its features in doing your advanced data modeling.

WARNING You cannot import data tables from the Windows Azure Marketplace or using an OData data feed using the Get

External Data command button in the Power Pivot window if Microsoft.NET Full Framework 4.0 or higher is not already installed on the device running Excel. If you don't want to or can't install this very large library of software code describing network communications on your device, you must import the data for your PivotTables from these two sources in the Excel program window, using the appropriate options on its Get Data button's drop-down menu found on the Data tab of its Ribbon.

Switching between the Data View and Diagram View

Diagram View is among the most useful features for data modeling offered by the Excel PowerPivot add-in. When you switch from the default Data View to Diagram View either by clicking the Home tab's Diagram View button or the Diagram button in the lower-right corner to the right of the Display button, all the data tables used in the Data Model are graphically displayed in the PowerPivot window, as shown in Figure 2-17 (sample workbook: Contoso Sales PivotTable.xlsx).

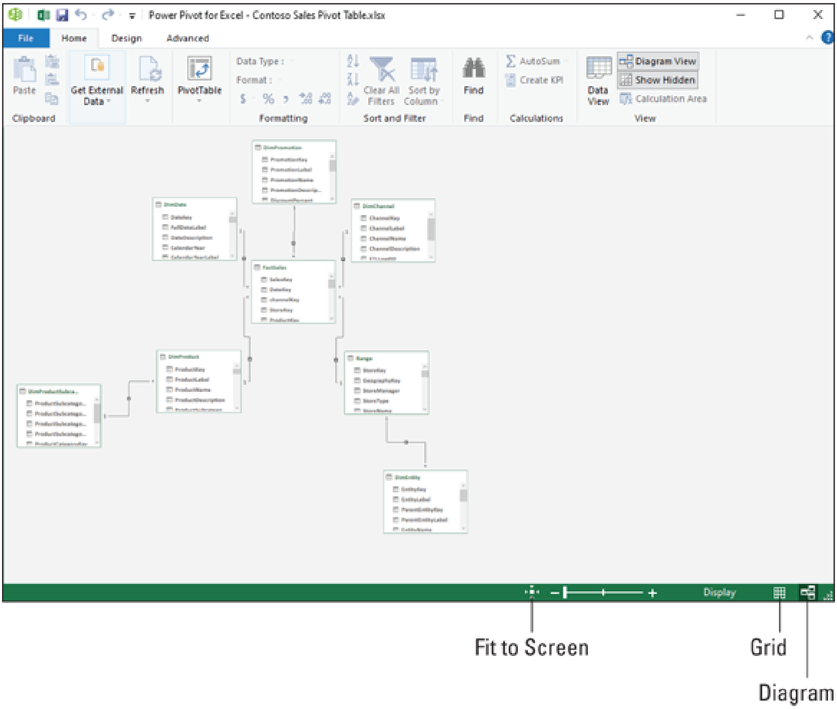

Power Pivot for Excel - Contoso Sales Pivot Table.xlsx
File
Home
Design
Advanced
Paste
Clipboard
Get External Data
Refresh
PivotTable
Data Type :
Format :
Formatting
Clear All Filters
Sort by Column
Sort and Filter
Find
Find
AutoSum
Create KPI
Calculations
Data View
Diagram View
Show Hidden
Calculation Area
View
Display
Fit to Screen
Grid
Diagram

FIGURE 2-17: Switching from Data View to Diagram View in the Power Pivot for Excel window.

(Sample workbook: Contoso Sales PivotTable.xlsx)

Each data table graphic object is labeled by name on its title bar and displays within it a list of all its fields. To see all the fields within a particular table, you may have to resize it by dragging the mouse or Touch pointer at its corners or midpoints. To avoid obscuring a data table below when enlarging a table located above it to display more of its fields, you can move either the upper or lower data table out of the way by dragging it by its title bar.

In addition to graphic representations of all data tables in the current Data Model, the Diagram View shows all existing relationships between them. It does this by drawing connecting lines between each of the related tables. The data table containing the primary key field is indicated by a dot at the end of its connecting line and the table containing the foreign key by an arrowhead at the end of its line. To see the name of the key field in each related table, click the connecting line: Power Pivot then selects the fields in both tables indicated by surrounding them with blue outlines.

Not only can you easily review the relationships between data tables in Diagram View, but you can also modify them. The most usual way is to create relationships between unrelated tables by locating their key fields and then literally drawing a line between the tables. To locate fields shared by two data tables in the Power Pivot diagram in either a one-to-one or one-to-many relationship, you can expand the data table graphics to display the entire list of their fields as well as use the Zoom slider at the top of the window beneath the Ribbon to zoom in and out on the tables. (To see all the tables at once, click the Fit to Screen button to the immediate left of the Zoom slider.)

In addition to visually locating shared fields, you can also use PowerPivot's search feature (by clicking the Find button on the Home tab) to search for particular field names. When you locate two tables that share a field that may work as a key field, you can relate them by dragging a line from the potential key field in one table to the key field in the other. When you release the mouse button or remove your finger or stylus on a touchscreen device, Excel draws a blue outline between the tables indicating the new relationship based on the two shared fields.

WARNING If the shared fields don't represent a one-to-one or one-to-many relationship (see Book 6, Chapter 2 for details) because the values in one or both are not unique, Excel displays an alert dialog box indicating that the PowerPivot is not able to establish a relationship between your tables. In such a case, you are forced to find another data table in the Data Model that contains the same field, but this time with unique values (that is, no duplicates). If no such field exists, you're unable to add to the table in question to the Data Model and, as a result, your Excel PivotTable won't be able to summarize its data.

TIP To make it easier to draw the line that creates the relationship between two data tables with a shared key field, you should position the tables near one another in the Diagram View. Remember that you can move the data table graphic objects around in the Power Pivot for Excel window by dragging them by their title bars.

FOR MORE ON DATA MODELING WITH POWER PIVOT FOR EXCEL

Being able to establish relationships between data tables in Diagram View represents just a small part of Power Pivot's data modeling capabilities. To find out more about data modeling with Power Pivot for Excel, be sure to check out *Microsoft Excel Power Pivot & Power Query For Dummies,* 2nd Edition by Michael Alexander.

Adding calculated columns courtesy of DAX

DAX stands for Data Analysis Expression and is the name of the language that Power Pivot for Excel uses to create calculations between the columns (fields) in your Excel Data Model. Fortunately, creating a calculation with DAX is more like creating an Excel formula that uses a built-in function than it is like using a programming language such as VBA or HTML.

This similarity is underscored by the fact that all DAX expressions start with an equal sign just like all standard Excel formulas and that as soon as you start typing the first letters of the name of a DAX function you want to use in the expression you're building, an Insert Function–like drop-down menu with all the DAX functions whose names start with those same letters appears. And as soon as you select the DAX function you want to use from this menu, PowerPivot not only inserts the name of the DAX function on the PowerPivot Formula bar (which has the same Cancel, Enter, and Insert Function buttons as the Excel Formula bar), but also displays the complete syntax of the function, showing all the required and optional arguments of that function immediately below the Formula bar.

In addition to using DAX functions in the expressions you create for calculated columns in your Data Model, you can also create simpler expressions using the good old arithmetic operators that you know so well from your Excel formulas (+ for addition, – for subtraction, * for multiplication, / for division, and so on).

To create a calculated column for your Data Model, PowerPivot must be in Data View. (If you're in Diagram View, you can switch back by clicking the Data View command button on the Power Pivot window's Home tab or by clicking the Grid button in the lower right corner of the PowerPivot window.) When Power Pivot for Excel is in Data View, you can create a new calculated field by following these steps:

1. **Click the tab of the data table in the Power Pivot window to which you want to add the calculated column.**
2. **Click the Add button on the Design tab of the Power Pivot Ribbon.**

   Power Pivot adds a new column at the end of the current data table with the generic field name, *Add Column.*
3. **Type = (equal sign) to begin building your DAX expression.**

   PowerPivot activates its Formula bar where it inserts the equal to sign.
4. **Build your DAX expression on the Power Pivot**

Formula bar more or less as you build an Excel formula in a cell of one of its worksheets.

To use a DAX function in the expression, click the Insert Function button on the Power Pivot Formula bar and select the function to use in the Insert Function dialog box (which is very similar to the standard Excel Insert Function dialog box except that it contains only DAX functions). To define an arithmetic or text calculation between columns in the current data table, you select the columns to use by clicking them in the data table interspersed with the appropriate operator. (See Table 1-1 in Book 3, Chapter 1 for a complete list of operators.)

To select a field to use in a calculation or as an argument in a DAX function, click its field name at the top of its column to add it to the expression on the Power Pivot Formula bar. Note that Power Pivot automatically encloses all field names used in DAX expressions in a pair of square brackets as in

```
=[UnitPrice]*[Quantity]
```

where you're building an expression in an extended price calculated column that multiplies the values in the UnitPrice field by those in the Quantity field of the active data table.

5. **Click the Enter button on the Power Pivot Formula bar to complete the expression and have it calculated.**

As soon as you click the Enter button, Power Pivot performs the calculations specified by the expression you just created, returning the results to the new column. (This may take several moments depending upon the number of records in the data table.) As soon as Power Pivot completes the calculations, the results appear in the cells of the Add Column field. You can then rename the column by double-clicking its Calculated Column *N* generic name, typing the new field name, and pressing Enter.

After creating a calculated column to your data table, you can view its DAX expression by clicking its field name at the top of its column in the Power Pivot Data View. If you ever need to edit its expression, you can do so by clicking the field name to select the entire column and then click the insertion point in the DAX expression displayed on the PowerPivot Formula bar. If you no longer need the calculated column in the PivotTable for its Data Model, you can remove it by right-clicking the column and then selecting Delete Columns on its shortcut menu. If you want to hide the column from the Data View, you select the Hide from Client Tools item on this shortcut menu.

REMEMBER DAX expressions using arithmetic and logical operators follow the same order of operator precedence as in regular Excel formulas. If you ever need to alter this natural order, you must use nested parentheses in the DAX expression to alter the order as you do in Excel formulas. (See Book 3, Chapter 1 for details.) Just be careful when adding these parentheses that you don't disturb any of the square brackets that always enclose the name of any data table field referred to in the DAX expression.

Using the 3D Maps Feature

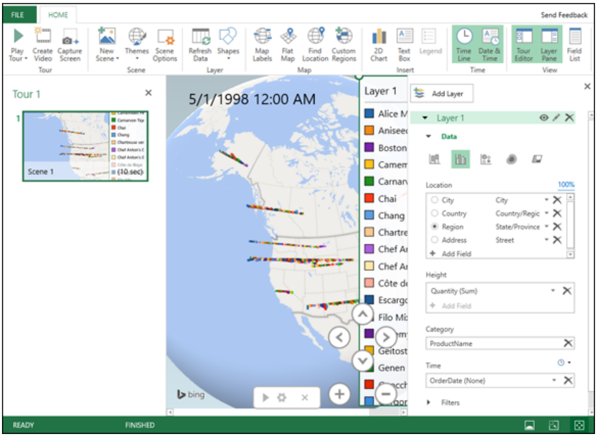
3D Maps is the name of an exciting visual analysis feature formerly known as Power Map in Excel 2016. 3D Maps enables you to use geographical, financial, and other types of data along with date and time fields in your Excel data model to create animated 3-D map tours.

To create a new animation for a tour in 3D Maps, follow these general steps:

1. **Open the worksheet that contains the data for which you want to create the 3D Maps animation.**
2. **Position the cell cursor in one of the cells in the table and then choose Insert ⇒ 3D Map ⇒ Open 3D Maps (Alt + NSMO) on the Excel Ribbon.**

   Excel opens a 3D Maps window with a new Tour (named Tour 1) with its own Ribbon with a single

Home tab similar to the one shown in Figure 2-18 (sample workbook: Northwind Orders with 3D Map.xlsx). This window is divided into three panes. The Layer pane on the right contains an outline of the default Layer 1 with three areas: Data, Filters, and Layer Options. The Data area in the Layer Pane is automatically expanded to display a Location, Height, Category, and Time list box. The central pane contains a 3-D globe on which your data will be mapped. A floating Field List containing fields in the selected Excel data model initially appears over this 3-D globe. The left Tour Editor pane contains thumbnails of all the tours and their scenes animated for your data model in 3D Maps (by default, there is just one scene marked Scene 1 when you create your first tour).


FILE
HOME
Send Feedback
Play Tour
Create Video
Capture Screen
Tour
New Scene
Themes
Scene Options
Scene
Refresh Data
Shapes
Layer
Map Labels
Flat Map
Find Location
Custom Regions
Map
2D Chart
Text Box
Legend
Insert
Time Line
Date & Time
Time
Tour Editor
Layer Pane
Field List
View
Tour 1
Scene 1
(10 sec)
5/1/1998 12:00 AM
bing
Layer 1
Alice M
Aniseed
Boston
Camem
Carnarv
Chai
Chang
Chartre
Chef A
Chef A
Côte d
Escargo
Filo Mi
Geitost
Genen
Add Layer
Layer 1
Data
READY
FINISHED

Location 100%
○ City — City
○ Country — Country/Region
● Region — State/Province
○ Address — Street
+ Add Field

Height
Quantity (Sum)
+ Add Field

Category
ProductName

Time
OrderDate (None)

Filters

FIGURE 2-18: 3D Maps window with new Clustered Column 3-D animation for visualizing the quantities ordered of various Northwind items between July 1996 and May 1998 at various locations in western Canada and United States. (Sample workbook: Northwind Orders with 3D Map.xlsx)

3. **Drag fields from the floating Field List to the Location, Height, Category, and Time list boxes in the Layer Pane to build your map.**

Drag the geographical fields whose location data are to be represented visually on the globe map and drop them into the Location list box in the Layer Pane. 3D Maps displays data points for each location field for your animation on the 3-D globe as you drop it into the Location list box. The program associates the selected location field with a geographical type in the drop-down list box to the right of the field name in the Location list box in the Layer pane. You can modify the type by selecting its drop-down button, if necessary. Just keep in mind that each location field needs to have a unique geographical type.

You also add fields from the floating Field List that you want depicted in the animation to the Height, Size, or Value list boxes (depending upon the type of visualization selected) as follows:

- Add values you want represented in the type of chart displayed on the 3-D map to the Height list box. By default, Excel uses the Sum function for value fields, but you can change this function to Average, Count, Maximum, Minimum, or No Aggregation by clicking its drop-down button in the Height list box.
- Add data fields that you want to appear as categories in the legend for the 3D Maps animation to Category list box. The items in this field are automatically added to a floating legend in the 3-D map if your chart type has a legend.
- Add date and time fields to the Time list box to set the time element for your 3D Maps animation. By default, 3D Maps does not associate the fields you add here to any time unit. You can specify the time unit by selecting Second, Minute, Hour, Day, Month, Quarter, or Year from the field’s drop-down list button in the Time list box.

7. **Select the type of visualization by clicking its icon under the Data heading in the Layer Pane: Stacked Column (default), Clustered Column, Bubble, Heat Map, or Region.**

3D Maps now displays data points for your Height, Size, or Value data on the 3-D globe appropriate to the type of visualization selected along with a floating legend for the data values (organized by any fields used as categories) in the center pane of the 3D Maps window. At the bottom of the map, you see a Time Line control with a play button that enables you to play and control the animation. (See Figure 2-19.)

8. **(Optional) Click the Map Labels button on the Ribbon to add country and city names to the maps on your 3-D globe.**

9. **(Optional) Click the Close the Layer Pane button and Close the Tour Editor button to hide the display of Layer and Tour Editor panes, respectively.**

   Now, your 3-D globe with the Layer 1 legend on the right side and animation timeline below fill the entire window below the 3D Maps Ribbon. Note that you can redisplay the Layer pane and the Tour Editor pane in the 3D Maps window at any time by clicking the Layer Pane or Tour Editor Ribbon buttons, respectively.

10. **(Optional) Drag the Layer 1 legend so that it’s not obstructing your 3-D globe. You can also resize the legend by selecting it and then dragging its sizing handles. If the Time Line animation control is obstructing key areas of the globe, you can hide it by clicking its Close button.**

    You can redisplay the Time Line control at any time by clicking the Time Line button in the Time group on the 3D Maps Ribbon. Note that you can’t reposition or resize the Time Line control when it is displayed and that you can play your animation by clicking the Play Tour button on the Ribbon when the Time Line control is hidden.

11. **(Optional) Drag the globe to display the area of the world with the locations you want to watch when you play your animation or use the Rotate Left (Shift + ←), Rotate Right (Shift + →), Tilt Up (Shift + ↑), or Tilt Down (Shift + ↓) buttons to bring this area into view. Then, click the Zoom In (Shift + +) or Zoom Out (Shift + -) to bring the area closer into view or further away.**

    Once you have the viewing window beneath the 3D Maps Ribbon positioned the way you want it when viewing your animation, you are ready to play the 3-D map tour you've created.

12. **Click the Play Tour button on the Ribbon or the Play button on the Time Line control (if it's still visible).**

    When you click the Play Tour button on the Ribbon, 3D Maps automatically hides the Tour Editor and Layer pane along with the Time Line control if they are still visible at that time. You can pause the animation by clicking the Pause button that appears in a cluster of controllers in a bar at the bottom of the screen or by pressing the spacebar on your keyboard. When you're finished watching the animation, return to the regular Editing view of 3D Maps by clicking the Go Back to Edit View button (the one with the arrow pointing left at the very beginning of the bar at the bottom of the screen) or pressing the Esc key on your keyboard.

13. **Click the Close button in the far-right corner of the 3D Maps title bar to close 3D Maps and return to your Excel worksheet and then save the workbook (Ctrl + S) to save your 3D Maps tour as part of the workbook file.**

After you create your initial animation tour for the data model in your Excel workbook, you can always replay it by reopening it in 3D Maps and clicking Play Tour on its Ribbon. To reopen the tour when the workbook with the data model is open in Excel, choose Insert ⇒ 3D

Map ⇒ Open 3D Maps on the Excel Ribbon (Alt + NSMO) and then click the Tour 1 button at the top of the Launch 3D Maps dialog box.

Once the tour is open in 3D Map, you can also edit it. You can change the appearance of the 3-D globe in your animation by selecting a new theme by clicking the Themes button in the Scene group of the 3D Maps Ribbon and then selecting a thumbnail on this button's drop-down palette. You can flatten the 3-D globe to make it two-dimensional by clicking the Flat Map button in the Map group of the Ribbon.

You can also add new layers to your original scene that animate a different data set over the same or a different set of date and time values. To add a new layer, click the Add Layer button at the top of the Layer task pane and then define the type of visualization and the fields to use in your data model for the location, analysis, and time (following the same steps as outlined earlier for creating the initial layer of the first scene of a new tour). After you add a new layer (automatically named Layer 1) to your original scene, 3D Maps shows the legends for both Layer 1 and 2 (which often overlap and need to be separated manually). 3D Maps also shows the data points for each layer's location, analysis, category, and time fields when you play the animation.

If you want to see the animation for just one of the layers in your scene, you can hide all the other layers before you play the animation. In the Layer task pane (click the Layer Pane button if you don't see this task pane), click the Show or Hide Layer In this Scene icon (the eyeball) to the right of the name of each layer you don't want to view in the animation.

USING POWER BI WITH EXCEL WORKSHEET DATA

If the individual maps provided by the 3D Maps add-in do not provide sufficient infographics for your worksheet data, try using Microsoft Power BI (Business Intelligence), a suite of data visualization and analytics software that works seamlessly with Excel worksheet data. You can download Power BI Desktop that enables you to load data sets and models saved in your Excel worksheets (as well as the other standard external data sources). In Power BI Desktop (which works a lot like Power Pivot), you can quickly build business dashboards containing clusters of tables, charts, and maps that visually identify key performance indicators inherent in your worksheet data, giving you a rundown on the relative health and well-being of your business at a glance. See `https://www.powerbi.com` for more on how to download, install, and use Power BI with Excel.

In addition to adding new layers to a scene, you can also add entirely new scenes to your tour that use a copy of the active scene, a new 3-D globe world, or a custom map with an entirely new background. To create a new scene, click the New Scene button in the Scene group of the 3D Maps Ribbon and then select Copy Scene, World Map, or New Custom Map options on its drop-down menu. After you select the type of scene, you then define the animation for the new scene using the steps you followed earlier in creating the opening animation for the first layer in the first scene of the tour. To play the animations you add to the layers of any new scene you add to your 3D Maps tour, you click the Scene thumbnail in the Tour Editor pane before you click the Play Tour button on the Ribbon or the Play button on its Time Line controller.

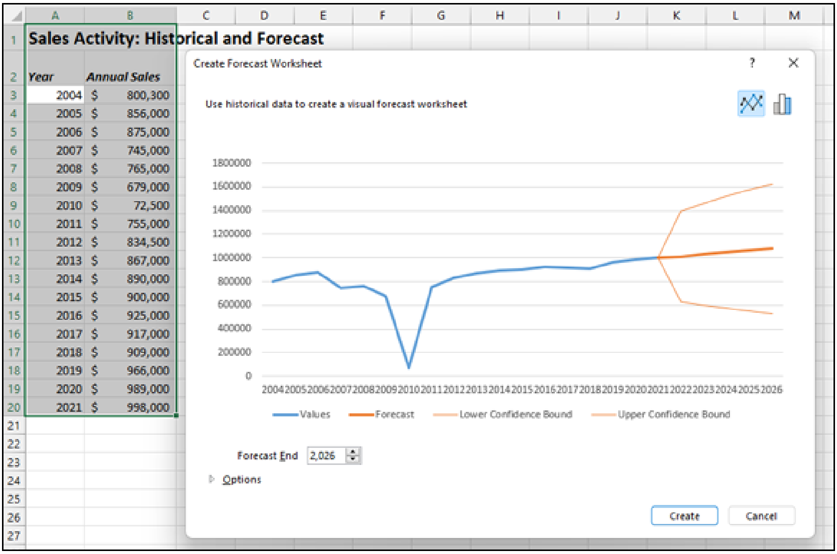
TIP Use the Create Video and Capture Screen buttons in the Tour group of the 3D Maps Ribbon to share completed animations with your colleagues and clients. Click Capture Screen to take a static picture of the visualization displayed on your 3-D globe that Excel saves in the Office Clipboard. Once in the Clipboard, you can use the Paste feature (Ctrl+V) to paste the graphic into a worksheet after you close 3D Maps and return to Excel.

Click the Create Video button to create a video of the animation for the currently selected scene and layer(s) in your tour. When you click this button, 3D Maps opens a Create Video dialog box where you choose the quality of the video selecting one of the following option buttons: Presentations & HD Displays (largest size and best quality at 1080 pixels), Computers and Tablets (medium size and quality at 720 pixels), or Quick Export & Mobile (lowest quality and smallest size at 360 pixels). If you want an existing music or narration file to accompany the animation, click the Soundtrack Options button and then select the sound file and the playback options followed by Apply before you click the Create button to make the video. 3D Maps then generates a video of the currently selected animation saved as .mp4 video file in your device’s default Video folder. You can then save this video file to a folder on your OneDrive or Dropbox to share with colleagues or clients. You can also play the video on your device using its default video player.

Creating Forecast Worksheets

The Forecast Sheet feature in Excel makes it super easy to turn a worksheet containing historical financial data into a remarkable visual forecast worksheet. All you do is open the worksheet with your historical data, position the cell cursor in one of its cells, and then choose Data ⇒ Forecast Sheet (or press Alt + AFC).

Excel then selects all the historical data in the surrounding worksheet table (which typically includes a column for dates as well as one for the related financial data) while at the same time opening the Create Forecast Worksheet dialog box, similar to the one shown in Figure 2-19 (sample workbook: Historical Sales.xlsx).



Sales Activity: Historical and Forecast

Year	Annual Sales
2004	$ 800,300
2005	$ 856,000
2006	$ 875,000
2007	$ 745,000
2008	$ 765,000
2009	$ 679,000
2010	$ 72,500
2011	$ 755,000
2012	$ 834,500
2013	$ 867,000
2014	$ 890,000
2015	$ 900,000
2016	$ 925,000
2017	$ 917,000
2018	$ 909,000
2019	$ 966,000
2020	$ 989,000
2021	$ 998,000

Create Forecast Worksheet

Use historical data to create a visual forecast worksheet

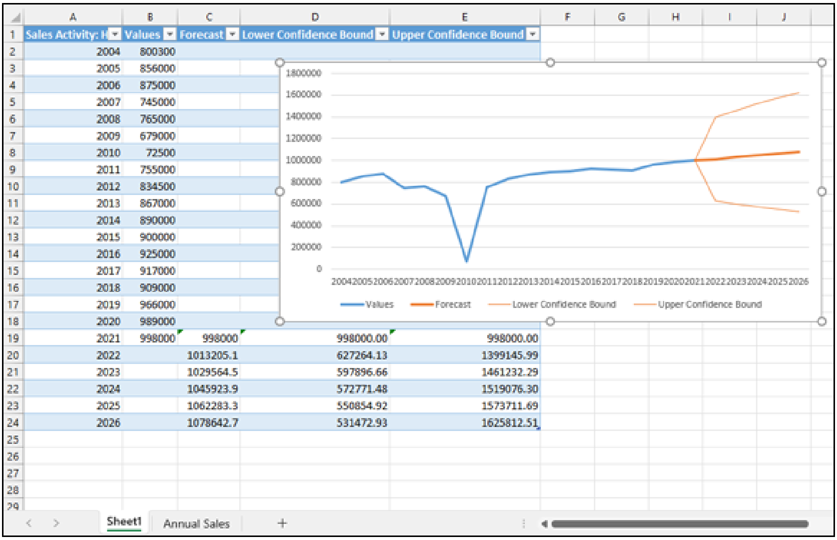
Forecast End 2,026

A
B
C
D
E
F
G
H
I
J
K
L
M
?
✕
1800000
1600000
1400000
1200000
1000000
800000
600000
400000
200000
0
2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026
Values
Forecast
Lower Confidence Bound
Upper Confidence Bound
Options
Create
Cancel

FIGURE 2-19: Defining the options for a new line chart that shows historical and projected sales in the Create a Forecast Worksheet dialog box. (Sample workbook: Historical Sales.xlsx)

By default, Excel selects a line chart to visually depict the trends in its forecast, but, if you wish, you can have the program use a column chart instead. Click the Column Chart icon to the immediate right of the Line Chart icon at the top of the Create Forecast Worksheet dialog box.

In addition to selecting the type of chart to be used in the forecast worksheet, you can also control the date at which the forecast chart ends. You do this by selecting a new date in the Forecast End text box that appears below the preview of the embedded line or column chart. For example, in Figure 2-20 (sample workbook: Historical Sales.xlsx), my historical data table includes annual sales for the years 2004 through 2021, and Excel automatically uses this data to extend the forecast end date out five years to 2026. If I wanted to extend the forecast beyond this end date, I would enter the new year into the Forecast End text box (or select one with the spinner buttons).



Sales Activity: H	Values	Forecast	Lower Confidence Bound	Upper Confidence Bound
2004	800300			
2005	856000			
2006	875000			
2007	745000			
2008	765000			
2009	679000			
2010	72500			
2011	755000			
2012	834500			
2013	867000			
2014	890000			
2015	900000			
2016	925000			
2017	917000			
2018	909000			
2019	966000			
2020	989000			
2021	998000	998000	998000.00	998000.00
2022		1013205.1	627264.13	1399145.99
2023		1029564.5	597896.66	1461232.29
2024		1045923.9	572771.48	1519076.30
2025		1062283.3	550854.92	1573711.69
2026		1078642.7	531472.93	1625812.51

A
B
C
D
E
F
G
H
I
J
1800000
1600000
1400000
1200000
1000000
800000
600000
400000
200000
0
2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026
Values
Forecast
Lower Confidence Bound
Upper Confidence Bound
Sheet1
Annual Sales
+

FIGURE 2-20: Worksheet with embedded line chart depicting historical and forecast sales created with the Forecast Sheet feature. (Sample workbook: Historical Sales.xlsx)

Beneath the Forecast End text box in the Create Forecast Worksheet dialog box, you find an Options button that when clicked (as shown in Figure 2-20) expands the dialog box to include the following options:

- **Forecast Start** enables you to select a starting date in the historical data later than the one Excel automatically selects (which is the first date in the worksheet table).
- **Confidence Interval** allows you to select a new degree of confidence that Excel uses to set the Lower- and Upper Confidence Bound line in the forecast when using the default line chart.
- **Seasonality** changes from the Detect Automatically to Set Manually option where you can enter or select a new value indicating the number of points in the values range of your data

table that are part of a recurring seasonal pattern. When Excel can't automatically detect seasonality in your worksheet data, a warning appears that so advises you and suggests that you select the Set Manually option button (and leave the default setting at zero) to get better results in the forecast.

- **Include Forecast Statistics** has Excel include a table of forecast accuracy metrics and smoothing factors in the resulting forecast worksheet.
- **Timeline Range** modifies the cell range containing the date values in your historical data (by default, Excel selects all these values it identifies in the current worksheet table).
- **Values Range** modifies the cell range containing the financial values in your historical data (by default, Excel selects all these values it identifies in the current worksheet table).
- **Fill Missing Points Using** to have Excel automatically fill in any missing data points it finds in the worksheet table in the forecast chart using either interpolation or zeros.
- **Aggregate Duplicates Using** modifies the statistical function.

After selecting all the desired options in the Create Forecast Worksheet dialog box, you have only to click the Create button to have Excel create a new forecast worksheet. This new sheet contains a formatted data table that combines your historical data with the forecast values as well as an embedded line or column chart (depending upon your selection) depicting the trend in both the historical and forecast values.

Figure 2-20 shows the new forecast worksheet that the Excel Forecast Sheet feature created for me using the original historical sales data shown in Figure 2-20 after I selected Set Manually option button with the setting at zero and selected the Include Forecast Statistics check box before clicking Create in the Create Forecast Worksheet dialog box. As you can see, Excel placed this new forecast worksheet (named Sheet1) before the worksheet containing my historical data (named Annual Sales).

Note that to display all the forecast values in the new formatted data table in Figure 2-20, I repositioned and resized the embedded line chart so that it fits nicely in the upper-right corner before taking the screenshot. If I wanted, I could move this chart to its own chart sheet before saving the new forecast table and chart as part of the Historical and Forecast Sales workbook.

Book 8

Macros and VBA

Contents at a Glance

Chapter 1: Recording and Running Macros

Macro Basics

Assigning Macros to the Ribbon and the Quick Access Toolbar

Macro Security

Chapter 2: VBA Programming

Using the Visual Basic Editor

Creating Custom Excel Functions

Chapter 1

Recording and Running Macros

IN THIS CHAPTER

- **Understanding how macros do what they do**
- **Recording macros for instant playback**
- **Using the relative option when recording macros**
- **Running the macros you've recorded**
- **Changing the macro security settings**
- **Assigning your macros to the Ribbon and Quick Access toolbar**

Macros enable you to automate almost any task that you can undertake in Excel. By using Excel's macro recorder to record tasks that you perform routinely, you not only complete tasks considerably faster (because Excel can play back your keystrokes and mouse actions much faster than you can perform them manually), but you are also assured that each step is carried out the same way every time you perform the task.

Excel's macro recorder records all the commands and keystrokes that you make in a language called Visual Basic for Applications (VBA), which is a special version of the BASIC programming language developed and refined by the good folks at Microsoft for use with all their Office application programs. You can then use Excel's Visual Basic Editor to display and make changes to the macro's VBA code.

In this chapter, you find out how to use Excel's macro recorder to record, test, and play back macros that you use to automate repetitive tasks required when building and using your Excel worksheets and charts. In the next chapter, you find out how to use Excel's Visual Basic

Editor to debug and edit the macros that you record, as well as to create complex macros that run custom functions and set up and run custom Excel applications, complete with their own pull-down menus and dialog boxes.

Macro Basics

You can create macros in one of two ways:

- Use Excel's macro recorder to record your actions as you undertake them in a worksheet.
- Enter the instructions that you want followed in VBA code in the Visual Basic Editor.

Either way, Excel creates a special *module* sheet that holds the actions and instructions in your macro. The macro instructions in a macro module (whether recorded by Excel or written by you) are stored in the Visual Basic for Applications programming language.

You can then study the VBA code that the macro recorder creates and edit this code in the Visual Basic Editor, which you open by clicking the Visual Basic command button on the Developer tab (when this optional tab is displayed on the Ribbon) or by pressing Alt+F11.

Getting ready to record

With Excel's macro recorder, you can create many of the utility-type macros that help you to perform the repetitive tasks necessary for creating and editing your worksheets and charts. When you turn on the macro recorder, the macro recorder records all your actions in the active worksheet or chart sheet as you make them. Note that the macro recorder doesn't record the keystrokes or mouse actions that you take to accomplish an action — only the VBA code required to perform the action itself. This means that mistakes that you make while taking an action that you rectify won't be recorded as part of the macro; for example, if you make a typing error and then edit it while the macro recorder is on, only the corrected entry shows up in the macro without the original mistakes and steps taken to remedy them.

The macros that you create with the macro recorder can be stored either as part of the current workbook, in a new workbook, or in a special, globally available Personal Macro Workbook named `PERSONAL.XLSB` that's stored in a folder called `XLSTART` on your hard disk. When you record a macro as part of your Personal Macro

Workbook, you can run that macro from any workbook that you have open. (This is because the `PERSONAL.XLSB` workbook is secretly opened whenever you launch Excel, and although it remains hidden, its macros are always available.) When you record macros as part of the current workbook or a new workbook, you can run those macros only when the workbook in which they were recorded is open in Excel. When that workbook is open, its recorded macros are available not only to the workbook itself, but also to any other workbook you have open.

When you create a macro with the macro recorder, you decide not only the workbook in which to store the macro but also what name and shortcut keystroke to assign to the macro that you are creating. When assigning a name for your macro, use the same guidelines that you use when you assign a standard range name to a cell range in your worksheet. When assigning a shortcut keystroke to run the macro, note that you can't use any of Excel's built-in key combos such as Ctrl+B and Ctrl+Shift+F. Outside of that, you can assign two types of keyboard shortcuts:

- Ctrl plus an unused letter from A to Z, such as Ctrl+Q.
- Ctrl+Shift plus an unused letter from A to Z, such as Ctrl+Shift+Q.

You can't, however, assign the Ctrl key plus a punctuation or number key (such as Ctrl+1 or Ctrl+/) to your macro.

The Ribbon's View tab contains a Macros command button to which a drop-down menu containing the following three options is attached:

- **View Macros:** Opens the Macro dialog box where you can select a macro to run or edit (Alt+WMV).
- **Record Macro:** Opens the Record Macro dialog box where you define the settings for your new macro and then start the macro recorder; this is the same as clicking the Record Macro button on the Status bar (Alt+WMR).
- **Use Relative References:** Uses relative cell addresses when recording a macro, making the macro more versatile by enabling you to run it in areas of a worksheet other than the ones originally used in the macro’s recording (Alt+WMU).

Excel also enables you to add a Developer tab to the Ribbon. This tab contains a Record Macro button and a Use Relative References button that you can use in recording your macros. To add the Developer tab to the Ribbon, follow these two steps:

1. **Choose File ⇒ Options and then click the Customize Ribbon tab or press Alt + FTC.**

   Excel opens the Customize the Ribbon pane within the Excel Options dialog box.

2. **Click the Developer check box in the Main Tabs list on the right side of the Customize the Ribbon pane in the Excel Options dialog box and then click OK.**

You can then turn on the macro recorder by doing any of the following:

- Click the Record Macro icon on the Excel Status bar (to the immediate right of the Ready indicator). Not seeing the Record Macro icon? Right-click the Status bar and then click to activate the Macro Recording command.
- Choose View ⇒ Macros ⇒ Record Macro (or press Alt + WMR).
- Choose Developer ⇒ Record Macro (or press Alt + LR).

Once you turn on the macro recorder, it records all your Excel actions as you make them.

Recording macros

To get a feel for how you create a macro with the macro recorder, follow along with these steps for creating a macro that enters the company name in 12-point, bold type and centers the company name across rows A through E with the Merge and Center feature:

1. **Open the Excel workbook that contains the worksheet data or chart you want your macro to work with.**

   If you're building a macro that adds new data to a worksheet (as in this example), open a worksheet with plenty of blank cells in which to add the data. If you're building a macro that needs to be in a particular cell when its steps are played back, put the cell cursor in that cell.

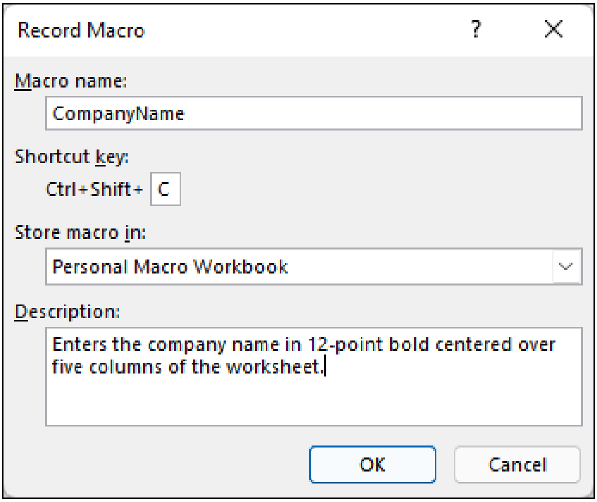
2. **Click the Record Macro button on the Status bar**

or choose View ⇒ Macros ⇒ Record Macro (or press Alt + WMR).

The Record Macro dialog box opens, similar to the one shown in Figure 1-1, where you enter the macro name, define any keystroke shortcut, select the workbook in which to store the macro, and enter a description of the macro's function.

3. **Replace the Macro1 temporary macro name by entering your name for the macro in the Macro Name text box.**

   When naming a macro, you must not use spaces in the macro name and it must begin with a letter and not some number or punctuation symbol. For this example macro, you replace Macro1 in the Macro Name text box with the name CompanyName.



Macro name: CompanyName

Shortcut key: Ctrl+Shift+ C

Store macro in: Personal Macro Workbook

Description: Enters the company name in 12-point bold centered over five columns of the worksheet.

FIGURE 1-1: Getting ready to record the CompanyName macro in the Record Macro dialog box.

4. **(Optional) Click the Shortcut Key text box and then type the letter that you want to assign to the Ctrl key combination that can run the macro. If**

you want to assign a Ctrl+Shift key combo, hold down Shift and then type the letter.

For this example macro, press Shift+C to assign Ctrl+Shift+C as the shortcut keystroke. (Interestingly, if you don't hold down Shift when you type C, Excel automatically changes the shortcut to Ctrl+Shift+C because the Ctrl+C shortcut is built in to Excel and can't be overwritten).

REMEMBER Alas, you can't enter just any letter between A and Z for your Ctrl or Ctrl+Shift shortcut key. That's because Excel has already assigned a number of Ctrl+letter and Ctrl+Shift+letter keystroke shortcuts for doing common tasks, such as Ctrl+C for copying an item to the Clipboard and Ctrl+Shift+F for displaying the Format Cells dialog box. These built-in shortcuts are set in stone, so Excel doesn't allow you to override them.

5. **Select the Personal Macro Workbook, New Workbook, or This Workbook item from the Store Macro In drop-down list to indicate where to store the new macro.**

   Select Personal Macro Workbook from the Store Macro In drop-down list box to be able to run the macro anytime you like. Select This Workbook (the default) when you need to run the macro only when the current workbook is open. Select New Workbook if you want to open a new workbook in which to record and save the new macro. If you go with the New Workbook or This Workbook option, see the "Saving your recorded macros in a macro-enabled workbook" section, later in this chapter, to learn how to save the workbook in a macro-friendly way.

For this example macro, select the Personal Macro Workbook so that you can use it to enter the company name in any Excel workbook that you create or edit.

6. **(Optional) Use the Description text box to type a brief description of the macro's purpose.**

   TIP Your description appears just above your recorded macro, so it's always a good idea to document the purpose and functioning of your macro in the Description text box. Although this step is optional, including a brief description every time you record a new macro means that you and your coworkers always know what to expect from the macro when you run it.

7. **Click OK.**

   Excel closes the Record Macro dialog box and you're ready to start recording your macro. Click the Use Relative References option on the Macros command button on the View tab or the Use Relative References command button on the Developer tab (when it's displayed) when you want the macro recorder to record the macro relative to the position of the current cell. Doing this often makes a macro more versatile as it enables you to run the macro in areas in the worksheet other than the cells used in its original recording.

8. **(Optional) Choose View ⇒ Macros ⇒ Use Relative References (or press Alt + WMU) or choose Developer ⇒ Use Relative References (or press Alt + LU) if you want to be able to play back the macro anywhere in the worksheet.**

9. **Select the cells, enter the data, and click the Excel**

commands required to perform the tasks that you want recorded just as you normally would in creating or editing the current worksheet, using either the keyboard or the mouse or a combination of the two.

For the example macro, all you do is type the company name and click the Enter button on the Formula bar to complete the entry in the current cell. Next, click the Bold button and then click 12 on the Font Size drop-down list on the Formatting toolbar. Finally, drag through cells A1:E1 to select this range and then click the Merge and Center button, again on the Formatting toolbar.

10. **When you're finished taking all the actions, click the Stop Recording button on the Excel Status bar or choose either View ⇒ Macros ⇒ Stop Recording or Developer ⇒ Stop Recording.**

TIP The Record Macro/Stop Recording button on the Status bar (to the immediate right of the Ready status indicator) is by far the most direct and easiest way to turn the macro recorder on and off. When using it to record a new macro, as soon as you click OK in the Record Macro dialog box to start recording your actions, this Record Macro button on the Status bar changes to a Stop Recording button, and you can click it when you are done recording all the actions to be included in the macro.

Running a macro

REMEMBER Before testing a new macro, you may need to select a new worksheet or at least a new cell range within the active worksheet. When recording cell references in a macro, the macro recorder always inserts absolute references in the macro sheet unless you click the Relative Reference button on the Stop Recording toolbar before you start choosing the commands and taking the actions in the worksheet that you want recorded as part of the macro. This means that your macro enters its data entries or performs its formatting in the same area of the active worksheet (unless the code in the macro itself causes the macro to first select a new area or select a new sheet in the active workbook).

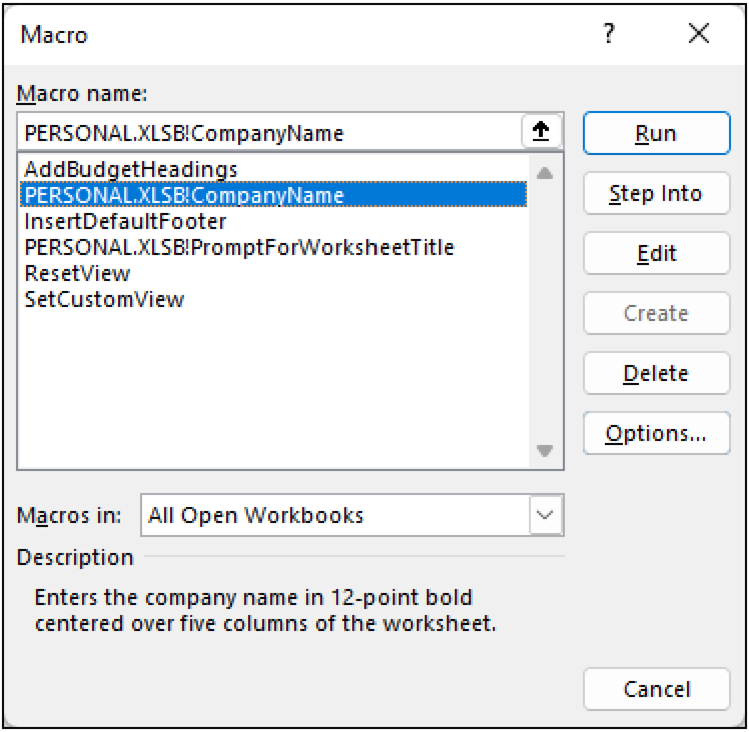
If you run your macro in a worksheet that already contains data in the cells that the macro uses, you run the risk of having existing data and/or formatting overwritten during the macro's execution. Keep in mind that, although you can use the Undo feature to reverse the very last action performed by your macro, most macros perform a series of actions, so you may end up using multiple levels of Undo before you are able to successfully reconstruct your spreadsheet.

If your recorded macro makes changes to the worksheet, select the starting cell you want the macro to use. You usually run the macro from the Macro dialog box, which you can coax onto the screen by doing any of the following:

- Choose View ⇒ Macros ⇒ View Macros (or press Alt+WMV).
- Choose Developer ⇒ Macros (or press Alt+LPM).
- Press Alt+F8.

Excel then opens the Macro dialog box, which is similar to the one shown in Figure 1-2. As this figure shows, Excel uses the Macro Name list box to display the names of all the macros in the current workbook, your Personal Macro Workbook (provided you've created one), and any other open workbook. Here are three things to notice about this list:

- Macros in the active workbook appear as just the macro name (such as AddBudgetHeader and InsertDefaultFooter in Figure 1-2).
- Macros in any other open workbook appear with the name of the workbook, followed by an exclamation point (!), and then the macro name (such as PERSONAL.XLSB!CompanyName in Figure 2-1).
- When you select a macro in the Macro Name list, the macro's description (assuming you entered one) appears in the Description section of the Macro dialog box.



Macro name: PERSONAL.XLSB!CompanyName

AddBudgetHeadings
PERSONAL.XLSB!CompanyName
InsertDefaultFooter
PERSONAL.XLSB!PromptForWorksheetTitle
ResetView
SetCustomView

Macros in: All Open Workbooks

Description

Enters the company name in 12-point bold centered over five columns of the worksheet.

FIGURE 1-2: Selecting the macro to run in the Macro dialog box.

Click the name of the macro that you want to use and then click Run to launch the macro.

If you assigned a shortcut keystroke to the macro, you don't have to bother opening the Macro dialog box to play the macro: Press Ctrl plus the letter key or Ctrl+Shift plus the letter key that you assigned and Excel immediately plays back all of the commands that you recorded.

Saving your recorded macros in a macro-enabled workbook

For each recorded macro, you have the option of storing the macro in the current workbook or a new workbook. You may choose either option rather than the Personal Macro Workbook if you plan to distribute your workbook to other people, so it's important for your macros to be distributed along with the rest of the workbook data.

However, Excel macros aren't compatible with the default Excel Workbook file format (.xlsx). If you try to save a workbook that contains recorded macros using the Excel Workbook file format, Excel strips out the macros! (Although Excel does have the decency to warn you this is going to happen.) To avoid losing your recorded macros, you need to save your workbook using the Excel Macro-Enabled Workbook file format (.xlsm). Here's how:

1. **With the workbook you used to store your record macros active, choose either File ⇒ Save (if your workbook is new and unsaved) or File ⇒ Save As (if your workbook was saved before you recorded your macros).**

   Either way, Excel displays the Save As screen.

2. **Select a location for the workbook.**
3. **If you're saving a new workbook, type a filename.**
4. **In the list of file formats, select Excel Macro-Enabled Workbook (*.xlsm).**
5. **Click Save.**

   Excel saves your file in the Excel Macro-Enabled Workbook format with the `.xlsm` file extension.

Assigning Macros to the Ribbon and the Quick Access Toolbar

Instead of running a macro by selecting it in the Macro dialog box or by pressing shortcut keys you assign to it, you can assign the macro to a custom tab on the Ribbon or a custom button on the Quick Access toolbar and then run it by clicking that custom button.

Adding your macros to a custom tab on the Ribbon

To assign a macro to a custom tab on the Ribbon, follow these steps:

1. **Choose File ⇒ Options and then click the Customize Ribbon button in the Excel Options dialog box (or press Alt+FTC).**

Excel displays the Customize the Ribbon pane in the Excel Options dialog box.

2. **Click Macros in the Choose Commands From drop-down list box on the left.**

   Excel lists the names of the all the macros created in the current workbook and saved in the `PERSONAL.XLSB` workbook or any other open workbooks in the Choose Commands From list box. Note, too, that you may see other macros listed here if you've enabled certain add-ins, particularly the Analysis ToolPak.

3. **Click the name of the custom group on the custom tab to which you want to add the macro in the Main Tabs list box on the right.**

   If you haven't already created a custom tab and group for the macro or need to create a new one, you then need to follow these steps:

   a. *Click the New Tab button at the bottom of the Main Tabs list.*

      Excel adds both a New Tab (Custom) and New Group (Custom) item to the Main Tabs list while at the same time selecting the New Group (Custom) item.

   b. *Click the New Tab (Custom) item you just added to the Main Tabs.*

   c. *Click the Rename button at the bottom of the Main Tabs list box and then type a display name for the new custom tab before you click OK.*

   d. *Click the New Group (Custom) item right below the custom tab you just renamed.*

   e. *Click the Rename button and then type a display name for the new custom group before you click OK.*

4. **In the Choose Commands From list box on the left, click the**

name of the macro you want to add to the custom group now selected in the Main Tabs list box on the right.

5. **Click the Add button to add the selected macro to the selected custom group on your custom tab.**

   By default, the name that Excel assigns to the command button is the macro name preceded by the name of the workbook in which the macro is stored, separated by an exclamation point (as in PERSONAL.XLSB!CompanyName). Excel also assigns a default “flowchart” icon to every macro command button. To make your Ribbon macro easier to differentiate and locate, you can customize both the button name and the button icon.

6. **With the macro command selected in the Customize the Ribbon list, click Rename.**

   Excel opens the Rename dialog box.

7. **Use the Symbol list to click the icon you want to assign to the macro command button, use the Display Name text box to rename the macro command button (note that you're just renaming the button, not the macro itself), and then click OK to return to the Excel Options dialog box.**
8. **Click OK.**

After you add a macro to the custom group of a custom Ribbon tab, the macro button appears in the custom tab on the Ribbon. To run the macro, click its command button.

Adding your macros to custom buttons on the Quick Access toolbar

If you have the Quick Access toolbar displayed (see Book 1, Chapter 1), you can assign a macro to a custom button on the Quick Access toolbar by following these steps:

1. **Click the Customize Quick Access Toolbar button at the end of the Quick Access toolbar and then click More Commands from the drop-down menu to open the Quick Access Toolbar tab of the Excel Options dialog box.**

2. **Select Macros from the Choose Commands From drop-down list box.**

   Excel lists the names of all the macros created in the current workbook and saved in the `PERSONAL.XLSB` workbook or any other open workbooks in the Choose Commands From list box. Other macros are listed here if you've enabled add-ins such as the Analysis ToolPak.

3. **Click the name of the macro to add to a custom button on the Quick Access toolbar in the Choose Commands From list box and then click the Add button.**

4. **With the macro command selected in the Customize the Quick Access Toolbar list, click Modify.**

   Excel opens the Modify Button dialog box.

5. **Use the Symbol list to click the icon you want to assign to the macro command button, use the Display Name text box to rename the macro command button (note that you're just renaming the button, not the macro itself), and then click OK to return to the Excel Options dialog box.**

6. **Click OK.**

A custom button with a macro name and icon appears on the Quick Access toolbar. To run the macro, click the button.

REMEMBER You can also assign macros to the graphic objects you add to your worksheet, including shapes you draw, clip art, and pictures you import. To assign a macro to a graphic object, right-click it and then click the Assign Macro option from its shortcut menu. Then click the name of the recorded macro to run in the list box of the Assign Macro dialog box and click OK. Thereafter, when you position the mouse pointer over the graphic object, the pointer becomes a hand with a pointing index finger (just like when you assign a hyperlink to a graphic — see Book 2, Chapter 1), indicating that you can click it to run the macro.

Macro Security

Excel uses a system called Microsoft Authenticode that enables developers to authenticate their macro projects or add-ins created with Visual Basic for Applications by a process referred to as *digital signing.* When you run a macro in your worksheet that's not saved in the trusted locations on your computer, such as the Templates and XLSTART folder in your user area on the computer, Excel checks to see whether the macro is digitally signed and that the signature is both valid and current. The macro's developer must have a certificate issued by a reputable authority or a trusted publisher.

If the program cannot verify a macro's digital signature (perhaps because it doesn't have one) or the trustworthiness of its macro publisher, the program then displays a security alert on the message bar underneath the Excel Ribbon. This alert area contains an Enable Content and a Trust Center command button. You can then click the Enable Content button to ignore the alert and go ahead and run the macro, assuming that you can vouch for the macro's publisher and are sure that running the macro poses no security risk to your computer. You click the Trust Center command button in the security alert on the message bar to open the Trust Center dialog box, where you can add to the trusted locations on your computer system and change the macro security settings.

REMEMBER You can also open the Macro Settings tab of the Trust Center dialog box by choosing Developer ⇒ Macro Security (or by pressing Alt+LAS) or clicking the Trust Center Settings button on the Trust Center tab of the Excel Options dialog box (Alt +FTT).

By default, Excel selects the Disable All Macros with Notification option button on the Macro Settings tab of the Trust Center dialog box. When this setting is selected, all macros that are not saved in one of the trusted locations are automatically disabled in the worksheet, but you do get a security alert each time you try to run one of these macros that enables you to ignore the alert and go ahead and run the macro by clicking the Enable Content button.

The Macro Settings tab of the Trust Center dialog box also contains these other options you can select:

- **Disable VBA Macros without Notification** to disable all macros not saved in one of your computer’s trusted locations and all security alerts so that you and the other users of the worksheet have no way to ignore the alert and run the macro. Select this option when you don’t trust someone else’s macros and want to make it impossible to run a macro carrying a computer virus.
- **Disable VBA Macros with Notification** (the default) to control the disabling of macros not saved in one of your computer’s trusted locations and security alerts. When you select this setting, worksheet users can ignore the alert and run the macro. Select this option when you want to maintain control over running potentially untrustworthy macros.
- **Disable VBA Macros except Digitally Signed Macros** to automatically enable digitally signed macros from a publisher that you’ve indicated is trustworthy and to disable all macros that are not digitally signed without notification. When you select this option and try to run a digitally signed macro that’s not from a publisher you’ve indicated is trustworthy, Excel displays an alert in the message bar with a Trust All Documents from This Publisher button that you can select, thereby adding the publisher to the trusted list.
- WARNING **Enable VBA Macros (Not Recommended; Potentially Dangerous Code Can Run)** to throw all caution to the wind and allow all macros to run in any worksheet you open. This is one option you never ever want to select, because it could cause serious damage to your machine!
- **Enable Excel 4.0 Macros When VBA Macros Are Enabled** to allow Excel's pre-VBA macros to run when you've selected the Enable VBA Macros option.
- **Trust Access to the VBA Project Object Model** to grant access to Visual Basic for Applications object model (see Book 8, Chapter 2) from an automation client.

To change the trusted locations on your computer, you need to click the Trusted Locations tab in the Trust Center dialog box. You can then use these options to change the location settings:

- **Add New Location:** Use this command button to open the Microsoft Office Trusted Location dialog box, where you select a new folder on your computer as a trusted location either by entering its directory pathname in the Path text box or selecting it with the Browse button. Check the Subfolders of This Location Are Also Trusted box if you want all subfolders within the designated folder to be included as trusted locations.
- **Allow Trusted Locations on My Network (Not Recommended):** Check this box so that you can designate folders to which you have access on your local network as trusted locations using the Add New Location command button (as described in the immediately preceding bullet point).
- **Disable All Trusted Locations:** Check this box to immediately disable all the folders currently designated as trusted locations and allow only macros from publishers designated as trustworthy to run in Excel.

Chapter 2

VBA Programming

IN THIS CHAPTER

- **Getting familiar with Visual Basic for Applications and the Visual Basic Editor**
- **Editing and running a macro in the Visual Basic Editor**
- **Creating a dialog box that prompts you for input for your macro**
- **Writing new macros in the Visual Basic Editor**
- **Using VBA to create user-defined functions**
- **Using your user-defined functions in your worksheets**
- **Saving user-defined functions as Excel Add-ins**

The subject of this chapter is Visual Basic for Applications (usually shortened to VBA), which is the official programming language of Excel (and the other main Office apps), and how you can use it to edit the macros that you record (as described in Book 8, Chapter 1) as well as to write new macros. The key to editing and writing macros in VBA is its editing program, the Visual Basic Editor (often abbreviated as VBE). The Visual Basic Editor offers a rich environment for coding and debugging VBA code.

VBA is a huge subject, well beyond the scope of this book. In this chapter, I introduce you to the Visual Basic Editor, and I explain how to use it to do basic macro editing. I also show you how to use the Visual Basic Editor to create custom Excel functions that you can then use when building formulas in your Excel worksheets. Custom functions (also known as *user-defined functions* or UDFs) work just like built-in functions except that they perform only the calculations that you define, by using just the arguments that you specify.

If this basic introduction to Visual Basic for Applications and using the

Visual Basic Editor inspires you to go on and try your hand at real VBA project development in Excel, I recommend *Excel VBA Programming For Dummies,* 5th Edition by Michael Alexander as an excellent next step. This book gives you the lowdown on all the ins and outs of VBA programming in that old, familiar, down-home *For Dummies* style that you've come to know and love.

Using the Visual Basic Editor

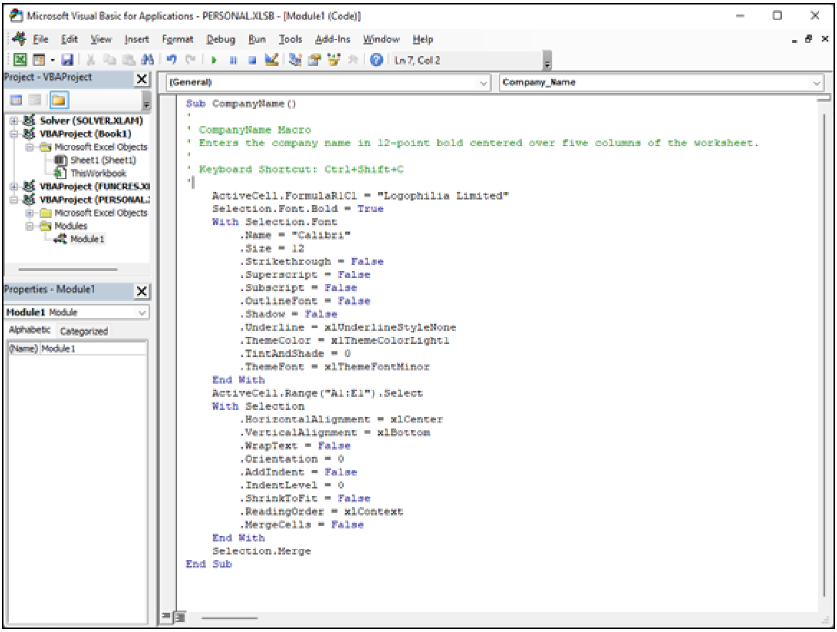
The first question that you may have is where the heck did they stick this Visual Basic Editor that you've heard so much about? Actually, the Visual Basic Editor is always ready to step forward whenever you press Alt+F11 or choose Developer ⇒ Visual Basic (or press Alt+LV) when the Developer tab is displayed on the Ribbon.

REMEMBER The Developer tab is not one of the default tabs on the Ribbon. If your Ribbon doesn't have a Developer tab, this just means that you haven't yet added it to the Ribbon, something you definitely want to do when working with macros. To add the Developer tab, choose File ⇒ Options ⇒ Customize Ribbon, select the Developer check box in the Main Tabs list box, and then click OK.

Figure 2-1 shows the arrangement of the typical components in the Visual Basic Editor after you first open its window and open a new module sheet. As you can see, this window contains its own menu bar. Beneath the menu bar, you find a Visual Basic Editor Standard toolbar. This toolbar, shown in Figure 2-2, contains several buttons that you may use when creating and editing VBA code.

Beneath the Standard toolbar in the Visual Basic Editor, you find several tiled windows of various sizes and shapes. Keep in mind that these are the default windows. They aren't the only windows that you can have open in the Visual Basic Editor (as though it weren't crowded and confusing enough), nor is this the only way that they can be arranged.

The two most important windows (at least, when you're first starting out using the Visual Basic Editor) are the Project Explorer window and the Code window. The Project Explorer window, which is located near the upper-left corner of the Visual Basic Editor window, just under the toolbar, shows you all the projects that you have open in the Visual Basic Editor and enables you to easily navigate their various parts. Note that in VBA, a *project* consists of all the code and user forms that belong to a particular workbook along with the sheets of the workbook itself.


Microsoft Visual Basic for Applications - PERSONAL.XLSB - [Module1 (Code)]
File Edit View Insert Format Debug Run Tools Add-Ins Window Help
Ln 7, Col 2
Project - VBAProject
Solver (SOLVER.XLAM)
VBAProject (Book1)
Microsoft Excel Objects
Sheet1 (Sheet1)
ThisWorkbook
VBAProject (FUNCRES.XL
VBAProject (PERSONAL.
Microsoft Excel Objects
Modules
Module1
Properties - Module1
Module1 Module
Alphabetic
Categorized
(Name) Module1
(General)
Company_Name

```
Sub CompanyName()
'
' CompanyName Macro
' Enters the company name in 12-point bold centered over five columns of the worksheet.
'
' Keyboard Shortcut: Ctrl+Shift+C
'
    ActiveCell.FormulaR1C1 = "Logophilia Limited"
    Selection.Font.Bold = True
    With Selection.Font
        .Name = "Calibri"
        .Size = 12
        .Strikethrough = False
        .Superscript = False
        .Subscript = False
        .OutlineFont = False
        .Shadow = False
        .Underline = xlUnderlineStyleNone
        .ThemeColor = xlThemeColorLight1
        .TintAndShade = 0
        .ThemeFont = xlThemeFontMinor
    End With
    ActiveCell.Range("A1:E1").Select
    With Selection
        .HorizontalAlignment = xlCenter
        .VerticalAlignment = xlBottom
        .WrapText = False
        .Orientation = 0
        .AddIndent = False
        .IndentLevel = 0
        .ShrinkToFit = False
        .ReadingOrder = xlContext
        .MergeCells = False
    End With
    Selection.Merge
End Sub
```

FIGURE 2-1: The Visual Basic Editor window as it normally appears when editing a macro.

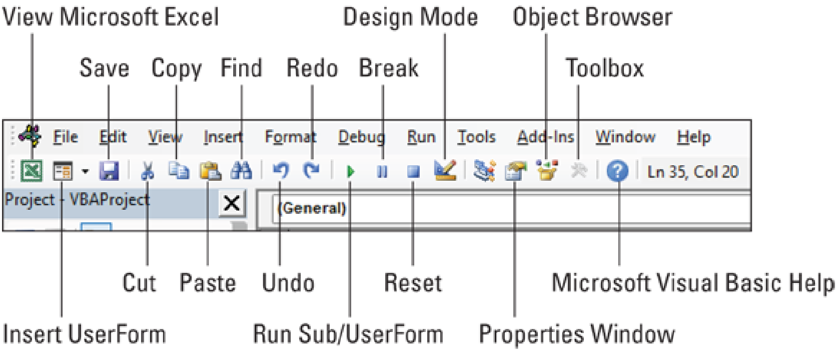

View Microsoft Excel
Design Mode
Object Browser
Save
Copy
Find
Redo
Break
Toolbox
File Edit View Insert Format Debug Run Tools Add-Ins Window Help
Ln 35, Col 20
Project - VBAProject
(General)
Cut
Paste
Undo
Reset
Microsoft Visual Basic Help
Insert UserForm
Run Sub/UserForm
Properties Window

FIGURE 2-2: The buttons on the Visual Basic Editor's Standard toolbar.

The macros that you record in the workbook, as well as any that you write for it in the Visual Basic Editor, are recorded on module sheets to which generic names are assigned, such as Module1, Module2, and so forth. The actual lines of VBA programming code for the macro that are stored on a particular module sheet appear in the Code window when you select its module in the Project Explorer window. (The Code window appears to the immediate right of the Project Explorer window.)

To open a module in the Code window, double-click its module icon in the Project Explorer or right-click the module icon and select View Code at the top of its shortcut menu.

TIP

If you want to rename a module in your VBA project to something a little more descriptive than Module1, Module2, and so on, you can do this in the Properties window that appears immediately below the Project Explorer. Click and drag through the name (such as Module1 or Module2) that appears after the label (Name) on the Alphabetic tab in the Properties window and replace it with a more descriptive name before you press Enter. When renaming a module, remember that you must use the same naming guidelines as when naming a range name in a worksheet: Begin the module name with a letter of the alphabet and don't put any spaces between words. (Use underlines instead.)

Editing recorded macros

After you've created a macro, you don't necessarily have to re-record it to change the way it behaves. In many cases, you will find it more expedient to change its behavior by editing its contents in the Visual Basic Editor. Note that if the macro you want to edit is stored in your Personal Macro Workbook (the `PERSONAL.XLSB` file in the XLSTART folder — see Book 8, Chapter 1 for details), you *must* unhide this workbook before you edit it in the Visual Basic Editor.

To unhide the Personal Macro Workbook, follow these steps:

1. **Choose View ⇒ Unhide Window (or press Alt + WU).**

   Excel opens the Unhide dialog box, which includes `PERSONAL.XLSB` in its Unhide Workbook list box.

2. **Click `PERSONAL.XLSB` in the Unhide Workbook list box and then click OK.**

   Excel makes the Personal Macro Workbook visible and activates it so that you can now edit its macros in the Visual Basic Editor.

To open a macro for editing in the Visual Basic Editor, follow these steps:

1. **Choose either Developer ⇒ Macros (or press Alt+LPM) or View ⇒ Macros ⇒ View Macros (or press Alt+WMV). Alternatively, press Alt+F8.**

   Excel opens the Macro dialog box showing all the names of the macros that you've defined in the active workbook, any other open workbooks, and in your Personal Macro Workbook.

2. **Click the name of the macro that you want to edit in the Macro Name list box and then click the Edit button.**

   Excel opens the Visual Basic Editor with the code for your macro displayed in the Code window unless you select the name of a macro saved in the Personal Macro Workbook and this workbook is still hidden. In that case, Excel displays an Alert dialog box telling you that you can't edit a hidden macro and informing you that you need to unhide this workbook. You then need to click OK in the Alert dialog box, press Escape to close the Macro dialog box, and then follow the steps for unhiding the Personal Macro Workbook immediately preceding these steps before you repeat these first two macro editing steps.

   After you have the lines of code for the macro displayed in the Code window in the Visual Basic Editor, you can edit any of its statements as needed.

   When editing the macro’s commands, remember that you can undo any deletion that you make by mistake (Edit ⇒ Undo; Ctrl + Z).

3. **Edit the statements in the Code window of the Visual Basic Editor as needed.**

   After you finish editing the macro, you're ready to return to your worksheet, where you can test the modified macro and make sure that you haven't added some wacky, unwanted command to the macro or, even worse, crippled it so that it no longer runs at all.

4. **Click the View Microsoft Excel button at the beginning of the Standard toolbar (see Figure 2-2) or click the workbook's minimized button on the Windows taskbar.**

   Select an appropriate or safe place in which to test your modified macro and then run it, either by pressing its shortcut keys or by pressing Alt + F8, clicking it in the Macro list box, and then clicking the Run button.

   If something doesn't work as intended or if the macro doesn't work at all, you need to return to the Visual Basic Editor and find and correct your error(s). Choose Developer ⇒ Visual Basic (or press Alt + LV) to return to the Visual Basic Editor and have a try at editing the code one more time.

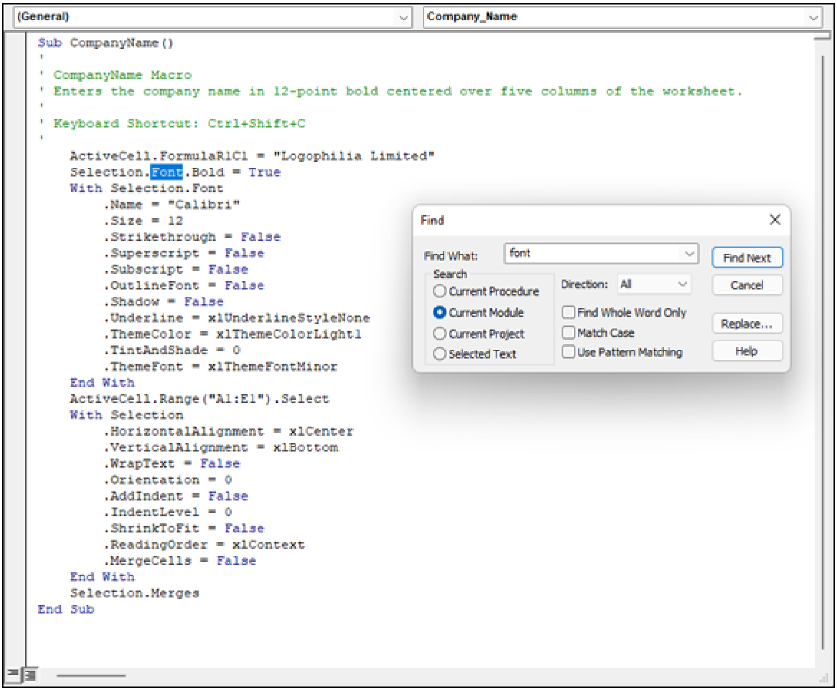
   If everything checks out and runs as planned, you need to save your changes as outlined in Step 5.

5. **Click the Save button on the Standard toolbar (see Figure 2-2) to save the changes to the modified macro if it's stored as part of the current workbook.**

Finding and replacing code in the macro

You can use the Find feature in the Visual Basic Editor to quickly locate the statements or properties that need editing in your macro. You open the Find dialog box, shown in Figure 2-3, by choosing Edit ⇒ Find on the menu bar, clicking the Find button on the Standard toolbar, or by pressing Ctrl+F. This dialog box is very similar to the one you use when finding entries in your Excel worksheet. The main difference is that the Find dialog box gives you different choices for what to search for (in addition to the familiar options for finding whole words only and matching case):

- **Current Procedure:** Search only the current macro in the Code window. In VBA, a *procedure* is a chunk of code between the `Sub` and `End Sub` statements, such as a recorded macro or some code that you write yourself. (A procedure is also sometimes called a *subprocedure*, hence the "Sub" short form in these statements.)
- **Current Module:** Search only the macros in the current module (the default).
- **Current Project:** Search all the macros in all modules within the current project.
- **Selected Text:** Search only the text that you've selected in the Code window (this option is only available when you've selected a block of text in the current code).



```
Sub CompanyName()
'
' CompanyName Macro
' Enters the company name in 12-point bold centered over five columns of the worksheet.
'
' Keyboard Shortcut: Ctrl+Shift+C
'
    ActiveCell.FormulaR1C1 = "Logophilia Limited"
    Selection.Font.Bold = True
    With Selection.Font
        .Name = "Calibri"
        .Size = 12
        .Strikethrough = False
        .Superscript = False
        .Subscript = False
        .OutlineFont = False
        .Shadow = False
        .Underline = xlUnderlineStyleNone
        .ThemeColor = xlThemeColorLight1
        .TintAndShade = 0
        .ThemeFont = xlThemeFontMinor
    End With
    ActiveCell.Range("A1:E1").Select
    With Selection
        .HorizontalAlignment = xlCenter
        .VerticalAlignment = xlBottom
        .WrapText = False
        .Orientation = 0
        .AddIndent = False
        .IndentLevel = 0
        .ShrinkToFit = False
        .ReadingOrder = xlContext
        .MergeCells = False
    End With
    Selection.Merges
End Sub
```

Find What: font

Search

○ Current Procedure

● Current Module

○ Current Project

○ Selected Text

Direction: All

☐ Find Whole Word Only

☐ Match Case

☐ Use Pattern Matching

FIGURE 2-3: Using the Find feature to locate the code to edit in the Code window.

After you enter the Visual Basic property or statement as your search string in the Find What text box, select the search options, and click the Find Next button, Excel attempts to locate its first occurrence in the code. When it does, the program highlights that occurrence in the current procedure, module, VBA project, or selected text block (depending on which Search option you use). To find the next occurrence, you can click the Find Next button in the Find dialog box again or, if you close this dialog box, press F3.

If you have several occurrences throughout the macro that require the same type of updating, you can use the Replace feature to both find and replace them in the macro code. This is particularly useful when you decide to change a particular value throughout a macro (such as selecting the cell range named “income 2021” for processing instead of the range “income 2022”), and you want to make sure that you don’t miss any occurrences.

To open the Replace dialog box, choose Edit ⇒ Replace on the Visual Basic Editor menu bar or press Ctrl + H. Note that you can open the Replace dialog box from within the Find dialog box by clicking its Replace button.

The Replace dialog box that appears is just like the Find dialog box, except that it contains a Replace With text box along with the Find What text box and has Replace and Replace All buttons in addition to the Find Next button. After entering the property or statement to find in the Find What text box and the one to replace it with in the Replace With text box, click the Find Next button to locate the first occurrence in the current procedure, module, VBA project, or selected text block (depending on which Search option you use). After this occurrence is selected in the Code window, you can replace it with the replacement text by clicking the Replace button. Excel then locates the next occurrence, which you can then replace by clicking the Replace button or pass over to find the next occurrence by clicking the Find Next button.

WARNING Don’t use the Replace All button to replace all the occurrences in your macro unless you’re 100 percent sure that you won’t be globally replacing something that shouldn’t be replaced and possibly screwing up your macro big time. I once typed `"selection.font.bold = ture"` into the Replace With text box when I intended to enter `"selection.font.bold = true"` as the replacement text when searching for the property `"Selection.Font.Bold = False"` in the macro. I then clicked the Replace All button only to discover to my dismay that I introduced this error throughout the code! Of course, I then had to turn around and use the Replace feature to find all the instances of “`selection.font.bold = ture`” and replace them with “`Selection.Font.Bold = true`”.

Changing settings for VBA properties

Even when you don't know anything about programming in VBA (and even if you aim to keep it that way), you can still get the gist of some of the more obvious properties in a macro that change certain settings, such as number format or font attribute, by experimenting with assigning them new values.

In the CompanyName macro shown previously in Figure 2-3, for example, you can tell that the section of VBA commands between the line

```
With Selection.Font
```

and the line

```
End With
```

contains the procedure for assigning various font attributes for the current cell selection.

Going a step further, you probably can figure out that most of these attributes are being reset by making the attribute equal to a new entry or value, such as

```
.Name = "Calibri"
```

or

```
.Size = 12
```

or an attribute is being reset by turning it on or off by setting it equal to True or False, such as

```
Selection.Font.Bold = True
```

to make the text in the current cell selection bold.

Now, it doesn't require a programming degree (at least, not the last time I checked) to get the bright idea that you can make your macro behave differently just by — *carefully* — editing these settings. For example, suppose that you want the final font size to be 24 points instead of 12. All you have to do is change

```
.Size = 12
```

to

```
.Size = 24
```

Likewise, you can have the macro apply single underlining to the cell selection by changing

```
.Underline = xlUnderlineStyleNone
```

to

```
.Underline = xlUnderlineStyleSingle
```

Getting macro input by adding a dialog box

One of the biggest problems with recording macros is that any text or values that you have the macro enter for you in a worksheet or chart sheet can never vary thereafter. If you create a macro that enters the heading "Bob's Barbecue Pit" in the current cell of your worksheet, this heading is the only one you'll ever get out of that macro. However, you can get around this inflexibility by using the InputBox function. When you run the macro, this Visual Basic function causes Excel to display an Input dialog box where you can enter whatever title makes sense for the new worksheet. The macro then puts that text into the current cell and formats this text, if that's what you've trained your macro to do next.

To see how to use the InputBox function to add interactivity to an otherwise staid macro, follow the steps for converting the CompanyName macro that currently inputs the text "Logophilia Limited" to one that prompts you for the name that you want entered. The InputBox function uses the following syntax:

```
InputBox(prompt[, title][, default][, xpos][, ypos][,
helpfile, context])
```

In this function, only the *prompt* argument is required with the rest of the arguments being optional. The *prompt* argument specifies the message that appears inside the Input dialog box, prompting the user to enter a new value (or in this case, a new company name). The *prompt* argument can be up to a maximum of 1,024 characters. If you want different parts of the prompt message to appear on different lines inside the dialog box, you include the VBA constant vbCrLf in the text (to insert a carriage return and a linefeed in the message), as in this example:

```
InputBox("Welcome to my Input Box!" & vbCrLf & "Input your
text here:")
```

The optional *title* argument specifies what text to display in the title bar of the Input dialog box. If you don't specify a *title* argument, Excel displays the name of the application on the title bar. The optional *default* argument specifies the default response that automatically appears in the text box at the bottom of the Input dialog box. If you don't specify a default argument, the text box is empty in the Input dialog box.

The *xpos* and *ypos* optional arguments specify the horizontal distance from the left edge of the screen to the left edge of the dialog box and the vertical distance from the top edge of the screen to the top edge of the dialog box. If you don't specify these arguments, Excel centers the input dialog box horizontally and positions it approximately one-third of the way down the screen vertically.

The *helpfile* and *context* optional arguments specify the name of the custom Help file that you make available to the user to explain the workings of the Input dialog box as well as the type of data that it accepts. As part of the process of creating a custom help file for use in the Excel Help system, you assign the topic a context number appropriate to its content, which is then specified as the *context* argument for the InputBox function. When you specify a help file and *context* argument for this function, Excel adds a Help button to the custom Input dialog box that users can click to access the custom help file in the Help window.

Before you can add the line of code to the macro with the InputBox function, you need to find the place in the Visual Basic commands where the line should go. To enter the Logophilia Limited text into the active cell, the CompanyName macro uses the following Visual Basic command on Line 8:

```
ActiveCell.FormulaR1C1 = "Logophilia Limited"
```

To add interactivity to the macro, you need to insert the InputBox function on a line in the Code window right above this

`ActiveCell.FormulaR1C1` statement, as follows:

1. **Position the insertion point in the Code window at the beginning of the `ActiveCell.FormulaR1C1` statement and press Enter to insert a new line.**

   Now that you've added a new line, you need to move the insertion point up to it.

2. **Press the ↑ key to position the insertion point at the beginning of the new line.**

   On this line, you want to create a variable that supplies the *prompt* argument to the InputBox function. To do this, you state the name of the variable (strPrompt in this case) followed by its current entry. Be sure to enclose the message text on the right side of the equal sign in a closed pair of double quotation marks.

3. **Type the following code to create the strPrompt variable on line 8 and then press the Enter key to start a new line 9:**

   ```
   strPrompt = "Enter the company name or title
   for this worksheet in the text box below and
   then click OK:"
   ```

4.

   TIP By convention, VBA variable names always start with a lowercase letter and subsequent “words” in the variable name begin with an uppercase letter. It's also a convention to start a variable name with text that defines the variable type, such as “str” for a string variable.

   Next, you create a variable named strTitle that supplies the optional *title* argument for the InputBox function. This variable makes the text “Worksheet Title” appear as the title of the Input dialog box. Again, be sure to enclose the name for the dialog box title bar in quotation marks.

5. **Type the following code to create the strTitle variable on line 9 and then press Enter to insert a new line 10:**

```
strTitle = "Worksheet Title"
```

Next, you create a variable name strDefault that supplies the optional *default* argument to the InputBox function. This variable makes the text, “Logophilia Limited” appear as the default entry in the text box at the bottom of the custom Company Name Input dialog box. Customize this text to suit your situation.

6. **Type the following code to create the strDefault variable on line 10 and then press Enter to insert a new line 11:**

```
strDefault = "Logophilia Limited"
```

Next, you create a final variable named strWorksheetTitle that specifies the InputBox function as its entry (using the strPrompt, strTitle, and strDefault variables that you just created) and stores the results of this function.

7. **Type the following code to create the strWorksheetTitle variable that uses the InputBox function on line 11:**

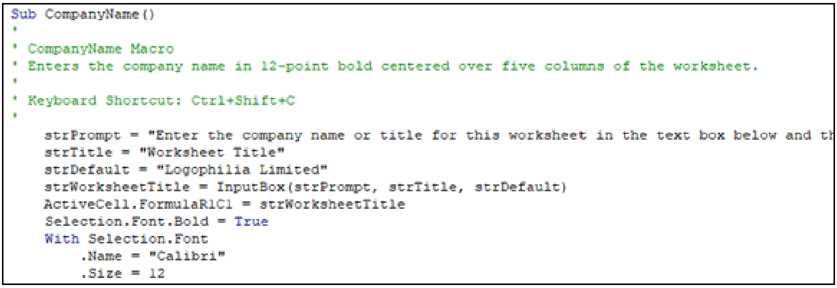
```
strWorksheetTitle = InputBox(strPrompt,
strTitle, strDefault)
```

Finally, you replace the value, “Logophilia Limited”, in the `ActiveCell.FormulaR1C1` property with the strWorksheetTitle variable (whose value is determined by whatever is input into the Worksheet Title dialog box), thus effectively replacing this constant in the macro with the means for making this input truly interactive.

8. **Select "Logophilia Limited" on line 12 and replace it with** strWorksheetTitle **(with *no* quotation marks).**
9. **Save the edited macro by clicking the Save button on the Visual Basic toolbar and then return to the worksheet by clicking the View Microsoft Excel button or pressing Alt+F11. Then, click the Hide button in the Window group of the VIEW tab.**

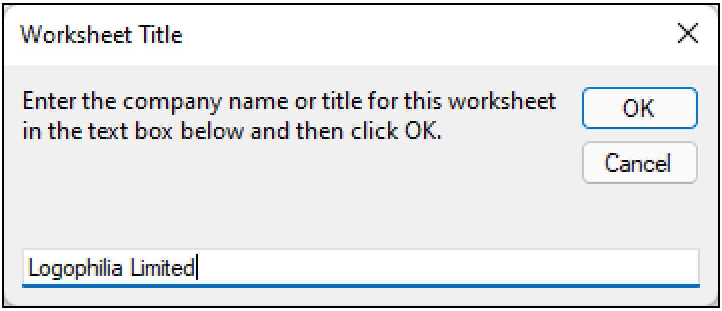
   Now, you're ready to open a new workbook (choose File ⇒ New or press Ctrl+N) and run the edited macro.

Figure 2-4 shows the Code window with the edited CompanyName macro after adding the statements that make it interactive. Figure 2-5 shows the Worksheet Title dialog box in action in the worksheet. This input dialog box now automatically appears and prompts you for input whenever you run the edited and now fully interactive version of the CompanyName macro.



```
Sub CompanyName()
'
' CompanyName Macro
' Enters the company name in 12-point bold centered over five columns of the worksheet.
'
' Keyboard Shortcut: Ctrl+Shift+C
'
    strPrompt = "Enter the company name or title for this worksheet in the text box below and th
    strTitle = "Worksheet Title"
    strDefault = "Logophilia Limited"
    strWorksheetTitle = InputBox(strPrompt, strTitle, strDefault)
    ActiveCell.FormulaR1C1 = strWorksheetTitle
    Selection.Font.Bold = True
    With Selection.Font
        .Name = "Calibri"
        .Size = 12
```

FIGURE 2-4: The CompanyName Code window after adding variables and the InputBox function.



Enter the company name or title for this worksheet in the text box below and then click OK.

Logophilia Limited

FIGURE 2-5: The Worksheet Title dialog box that appears when you run the CompanyName macro.

To go ahead and enter the default text into the current cell and then format it by using the rest of the macro commands, you just click OK in this custom dialog box. To enter and format the name of another company, you type the name of the company (which automatically replaces the default text) before you click OK.

WHY NOT TYPE IN THE ARGUMENTS OF THE INPUTBOX FUNCTION?

The biggest reason for using the variables strPrompt, strTitle, and strDefault to supply the *prompt, title,* and *default* arguments of the InputBox function — rather than just typing them into the function — is their length. If you typed all three pieces of text within the parentheses of the InputBox function, you would end up with long and difficult to decipher lines of code. When you use variables to do the job, as in the example shown previously, you end up with lines of code that fit on one screen, thus making the lines of code easier to read. If you use the variables on other procedures in the macro, declaring them all together at the beginning of the code also makes it easy to update their values.

Writing new macros in the Visual Basic Editor

After you learn the basics of the VBA language, you can write new macros from scratch in the Visual Basic Editor instead of just editing ones that you've previously recorded in your worksheet by using Excel's macro recorder. When creating a macro from scratch in the Visual Basic Editor, you need to follow these general steps:

1. **Click the name of the VBA project in the Project Explorer window where you want to add the new macro.**

   If you want to write a macro just for the current workbook, click the VBAProject function that contains its filename in parentheses, as in VBAProject (My Worksheet). If you want to write a global macro in the Personal Macro Workbook, click VBAProject (PERSONAL.XLSB) in the Project Explorer window.

2. **Choose Insert ⇒ Module on the Visual Basic Editor**

menu bar.

Excel responds by opening a new, blank Code window in the Visual Basic Editor window and by adding another Module icon (named with the next available number) in the outline in the Project Explorer window under the appropriate VBA Project.

3. **To begin your macro, type** sub **(short for subprocedure) and then press the spacebar.**
4. **Type the name of your macro and then press the Enter key.**

   Remember that in naming your new macro, you follow the same rules as when naming a range name (begin with a letter and no spaces).

   As soon as you press the Enter key, the Visual Basic Editor inserts a closed pair of parentheses after the macro's name, a blank line, and an End Sub statement on its own line below that. It then positions the insertion point at the beginning of the blank line between the lines with the Sub and End Sub statements. It’s here that you enter the lines of code for the macro that you’re writing.
5. **Enter the lines of VBA code for the macro in between the Sub and End Sub statements.**

   Before you begin writing the VBA statements that your macro is to execute, you should first document the purpose and function of this macro. To do this, type an apostrophe (') at the beginning of each line of this text to enter it as a comment. (Excel knows not to execute any line of code that’s prefaced with an apostrophe.) When you press the Enter key to start a new line that begins with an apostrophe, the line of text turns green, indicating that the Visual Basic Editor considers it to be a comment that’s not to be executed when the macro runs.

After you document the purpose of the macro with your comments, you begin entering the statements that you want the macro to execute (which must not be prefaced by apostrophes). To indent lines of code to make them easier to read, press Tab. If you need to outdent the line, press Shift+Tab. For help on writing VBA code, refer to the VBA online help. When you finish writing the code for your macro, you need to save it before you test it.

6. **Choose File ⇒ Save on the Visual Basic Editor menu bar or press Ctrl+S.**

After you save your new macro, you can click the View Microsoft Excel button on the Standard toolbar to return to your worksheet where you can try it. To run the new macro that you've written, choose either Developer ⇒ Macros or View ⇒ Macros (or press Alt+F8) to open the Macro dialog box, and then click the name of the macro that you just wrote before you click OK.

If Excel encounters an error when running the macro, it returns you to the Visual Basic Editor, and an Alert Microsoft Visual Basic dialog box appears, indicating (in very cryptic form) the nature of the error. Click the Debug button in this dialog box to have the Visual Basic Editor highlight the line of code that it can't execute. You can then attempt to find the mistake and edit it in the line of code. If you do eliminate the cause of the error, the Visual Basic Editor removes the highlighting from that line of code, and you can then click the Continue button (which automatically replaces the Run button when the Editor goes into debug mode) with the blue triangle pointing to the right on the Standard toolbar to continue running the macro.

Running macros in the Visual Basic Editor

Although it's usually best to run your macros from the Macro dialog box in Excel, it's also possible to run any macro from within the Visual Basic Editor. Here's how:

1. **If need be, switch to the worksheet in which you want your macro to make its changes and select the starting cell.**
2. **Switch back to the Visual Basic Editor.**
3. **Click anywhere inside the macro you want to run.**

4. **Use either of the following techniques to run the macro:**
    - To run the entire macro, choose Run ⇒ Run Sub/UserForm. You can also either click the Standard toolbar's Run Sub/UserForm button (pointed out earlier in Figure 2-2) or press F5.
    - To step through the macro one line at a time (useful for testing your macro to see what effect each line has on your worksheet), choose Debug ⇒ Step Into (or press F8). Repeat this command (you'll probably want to use the F8 shortcut for this) to execute one line at a time. If at any point you want to run the rest of the macro without stopping, press F5; to stop the macro at any time, choose Run ⇒ Reset or click the Standard toolbar's Reset button.

Creating Custom Excel Functions

One of the best uses of VBA in Excel is to create custom worksheet functions also known as *user-defined functions* (*UDFs* for short). User-defined functions are great because you don’t have to access the Macro dialog box to run them. In fact, you enter them into your worksheets just like you do any of Excel's built-in worksheet functions, either with the Insert Function button on the Formula bar or by typing them directly into a cell.

To create a user-defined function, you must do four little things:

- Create a new module sheet where the custom function is to be defined in the Visual Basic Editor by selecting its project in the Project Explorer window and then choosing Insert ⇒ Module on the Visual Basic Editor menu bar.
- Enter the name of the custom function and specify the names of the arguments that this function takes on in the first line in the Code window — note that you can’t duplicate any built-in function names, such as SUM or AVERAGE functions, and so on, and you must list argument names in the order in which they are processed and enclosed in parentheses.
- Enter the formula, or set of formulas, that tells Excel how to calculate the custom function’s result by using the argument names listed in the Function command with whatever arithmetic operators or built-in functions are required to get the calculation

made on the line or lines below.

- Indicate that you've finished defining the user-defined function by entering the End Function command on the last line.

To see how this procedure works in action, consider this scenario: Suppose that you want to create a custom function that calculates the sales commissions for your salespeople based on the number of sales they make in a month as well as the total amount of their monthly sales. (They sell big-ticket items, such as RVs.) Your custom Commission function will then have two arguments — *totalSales* and *itemsSold* — so that the first line of code on the module sheet in the Code window is

```
Function Commission(totalSales, itemsSold)
```

In determining how the commissions are calculated, suppose that you base the commission percentage on the number of sales made during the month. For five sales or fewer in a month, you pay a commission rate of 4.5 percent of the salesperson's total monthly sales; for sales of six or more, you pay a commission rate of 5 percent.

To define the formula section of the Commission custom function, you need to set up an If construction. This If construction is similar to the If function that you enter into a worksheet cell except that you use different lines in the macro code for the construction in the custom function. An Else command separates the command that is performed if the expression is True from the command that is performed if the expression is False. The macro code is terminated by an End If command. To set the custom function so that your salespeople get 4.5 percent of total sales for five or fewer items sold and 5 percent of total sales for more than five items sold, you enter the following lines of code underneath the line with the Function command:

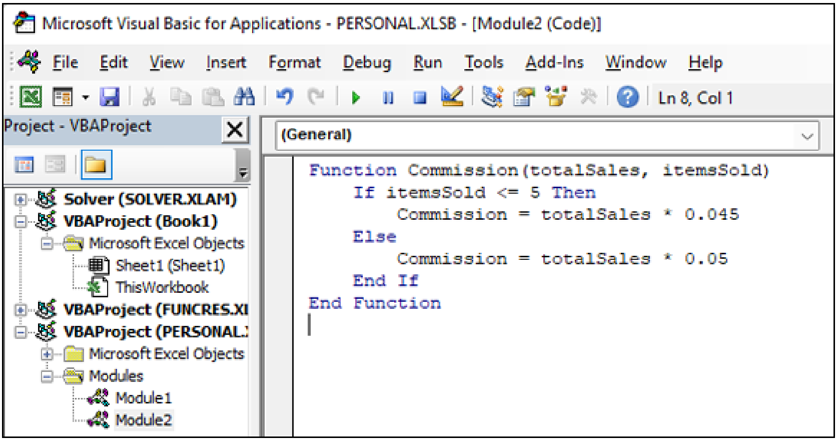
```
If itemsSold <= 5 Then
     Commission = totalSales * 0.045
Else
     Commission = totalSales * 0.05
End If
```

Figure 2-6 shows you how the code for this user-defined function appears in the Code window for its module sheets. The indents for the `If…End If` statements are made with the Tab key and make differentiating the parts of the If construction easy. The first formula, `Commission = totalSales * 0.045` is used when the If expression `itemsSold <= 5` is found to be True. Otherwise, the second formula underneath the Else command, `Commission =`

`totalSales * 0.05` is used.

After entering the definition for your user-defined function, you are ready to save it by choosing File ⇒ Save on the Visual Basic Editor menu bar or by pressing Ctrl + S. Then, you can click the View Microsoft Excel button on the Standard toolbar to return to the worksheet where you can try out your new custom function.

TIP If you want to be able to use your user-defined function in any worksheet you create, be sure that you select VBAProject (`PERSONAL.XLSB`) in the Project Explorer window before you open a new module and define the custom function there.


Microsoft Visual Basic for Applications - PERSONAL.XLSB - [Module2 (Code)]
File
Edit
View
Insert
Format
Debug
Run
Tools
Add-Ins
Window
Help
Ln 8, Col 1
Project - VBAProject
(General)
Solver (SOLVER.XLAM)
VBAProject (Book1)
Microsoft Excel Objects
Sheet1 (Sheet1)
ThisWorkbook
VBAProject (FUNCRES.XI
VBAProject (PERSONAL.
Microsoft Excel Objects
Modules
Module1
Module2

```
Function Commission(totalSales, itemsSold)
    If itemsSold <= 5 Then
        Commission = totalSales * 0.045
    Else
        Commission = totalSales * 0.05
    End If
End Function
```

FIGURE 2-6: Entering the Commission user-defined function in the Personal Macro Workbook.

Adding a description to a user-defined function

To help your user understand the purpose of your custom function, you can add a description that appears in the Insert Function and Function Arguments dialog boxes that helps explain what the function does. To add this kind of description to your user-defined function, you use the Object Browser, a special window in the Visual Basic Editor that enables you to get information about particular objects available to the project that you have open.

To add a description for your user-defined function, follow these steps:

1. **Open the Visual Basic Editor from Excel by choosing Developer ⇒ Visual Basic (or pressing Alt + LV or Alt + F11).**

   Now, you need to open the Object Browser.

2. **Choose View ⇒ Object Browser from the Visual Basic Editor menu bar or press F2.**

   This action opens the Object Browser window, which obscures the Code window.

3. **Click the drop-down list box that currently contains the value <All Libraries> and then select VBAProject from the drop-down list.**

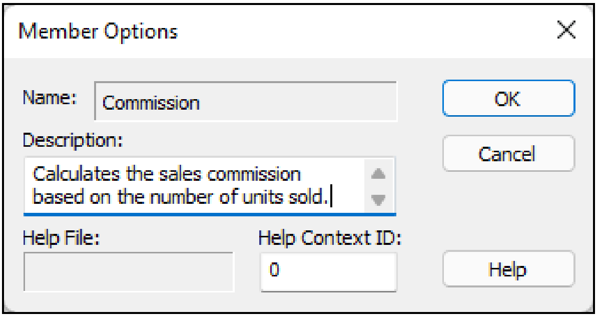
   When you select VBAProject from this drop-down list, the Object Browser then displays your user-defined function as one of the objects in one of the Classes in the pane on the left.

4. **Right-click the name of your user-defined function.**

   This action selects the function and displays it in the Members pane on the right, while at the same time displaying the object's shortcut menu.

5. **Click Properties on the shortcut menu.**

   This action opens the Member Options dialog box for your user-defined function, where you can enter your description of this function, as shown in Figure 2-7.



Calculates the sales commission based on the number of units sold.

FIGURE 2-7: Adding a description for the Commission user-defined function.

6. **Type the text that you want to appear in the Insert Function and Function Arguments dialog box for the user-defined function in the Description text box and then click OK.**

   Now, you can close the Object Browser and save your changes.

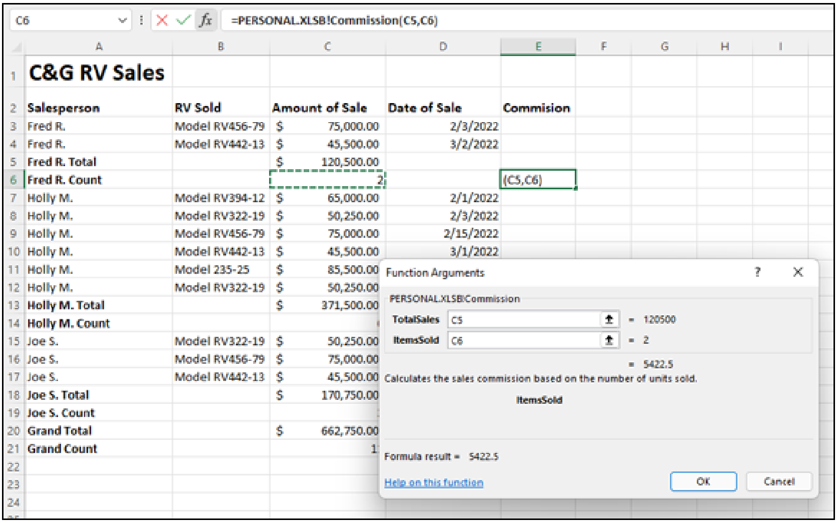
7. **Click the Close Window button to close the Object Browser and then choose File ⇒ Save.**

Using a custom function in your worksheet

The great thing about custom functions is that they can be inserted into your worksheets with the Insert Function button on the Formula bar. Figures 2-8, 2-9, and 2–10 (sample workbook: RV Sales.xlsx for all three) illustrate how easy it is to enter the custom Commission function in a worksheet with this button.

Figure 2-8 shows a worksheet that contains a table with the RV sales for three salespeople: Fred, Holly, and Joe. As you can see, the Automatic Subtotals feature (covered in Book 6, Chapter 1) has been used to compute both the monthly total sales (with the SUM function) and the number of sales (with the COUNT function) for each of these three salespeople.

To calculate the monthly commissions for each salesperson in this table, you select the cell where you want the first commission to be calculated (Fred's commission in cell E6). Click the Insert Function button on the Formula bar and then click User Defined at the very bottom of the Or Select a Category drop-down list. Doing this displays the PERSONAL.XLSB!Commission custom function in the Select a Function list box.



C6

=PERSONAL.XLSB!Commission(C5,C6)

C&G RV Sales

Salesperson	RV Sold	Amount of Sale	Date of Sale	Commision
Fred R.	Model RV456-79	$ 75,000.00	2/3/2022	
Fred R.	Model RV442-13	$ 45,500.00	3/2/2022	
Fred R. Total		$ 120,500.00		
Fred R. Count		2		(C5,C6)
Holly M.	Model RV394-12	$ 65,000.00	2/1/2022	
Holly M.	Model RV322-19	$ 50,250.00	2/3/2022	
Holly M.	Model RV456-79	$ 75,000.00	2/15/2022	
Holly M.	Model RV442-13	$ 45,500.00	3/1/2022	
Holly M.	Model 235-25	$ 85,500.00		
Holly M.	Model RV322-19	$ 50,250.00		
Holly M. Total		$ 371,500.00		
Holly M. Count				
Joe S.	Model RV322-19	$ 50,250.00		
Joe S.	Model RV456-79	$ 75,000.00		
Joe S.	Model RV442-13	$ 45,500.00		
Joe S. Total		$ 170,750.00		
Joe S. Count				
Grand Total		$ 662,750.00		
Grand Count		1		

Function Arguments

PERSONAL.XLSB!Commission

TotalSales C5 = 120500

ItemsSold C6 = 2

= 5422.5

Calculates the sales commission based on the number of units sold.

ItemsSold

Formula result = 5422.5

FIGURE 2-8: Selecting a cell in the RV Sales worksheet into which to enter the Commission function. (Sample workbook: RV Sales.xlsx)

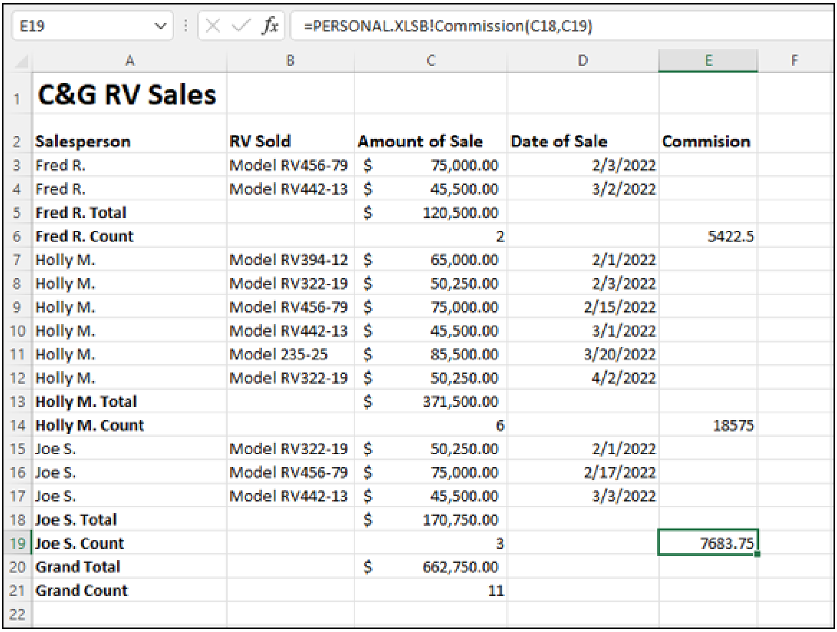
When you click OK after selecting the PERSONAL.XLSB!Commission function in the Insert Function dialog box, the Function Arguments dialog box appears, as shown in Figure 2-9. Here, you select cell C4 with Fred's total sales amount for April as the TotalSales argument and cell C5 with the number of sales made in that month as the ItemsSold argument.

When you click OK in the Function Arguments dialog box, Excel calculates Fred's commission by using the 4.5 percent commission rate because his two sales made in April are well below the five sales necessary to bump him up to the 5 percent commission rate used by the custom Commission function. Figure 2-10 shows the completed April sales table after calculating the monthly commissions for Fred, Holly, and Joe. In using the custom Commission function, both Fred and Holly fall into the 4.5 percent commission rate. Only Joe, the April RV sales king, gets paid the higher 5 percent commission rate for his six sales during this month.

Saving custom functions in add-in files

The only limitation to the user-defined functions that you save as part of a regular workbook file or the Personal Macro Workbook file is that when you enter them directly into a cell (without the use of the Insert Function dialog box), you must preface their function names with their filenames. For example, if you want to type the custom Commission function that's saved in the Personal Macro Workbook, you enter the following formula:

```
=Commission(C9,C10)
```

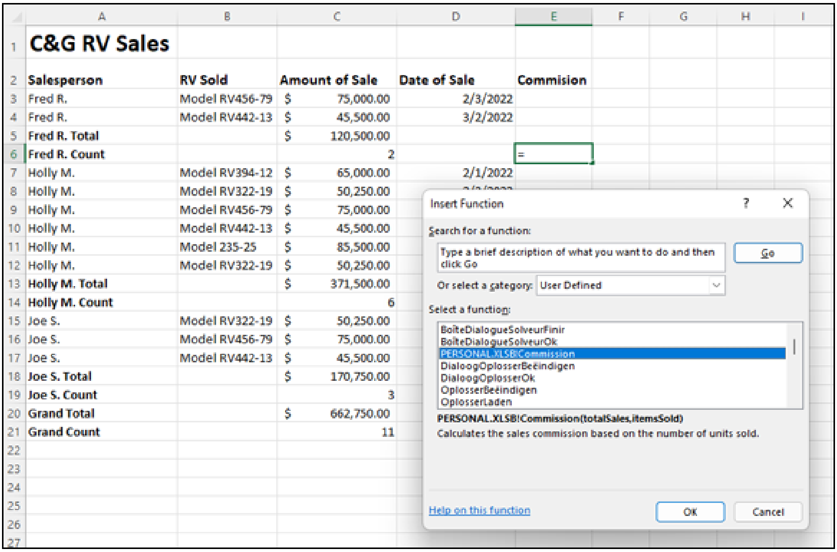


E19

`=PERSONAL.XLSB!Commission(C18,C19)`

	A	B	C	D	E	F
1	**C&G RV Sales**					
2	**Salesperson**	**RV Sold**	**Amount of Sale**	**Date of Sale**	**Commision**	
3	Fred R.	Model RV456-79	$ 75,000.00	2/3/2022		
4	Fred R.	Model RV442-13	$ 45,500.00	3/2/2022		
5	**Fred R. Total**		$ 120,500.00			
6	**Fred R. Count**		2		5422.5	
7	Holly M.	Model RV394-12	$ 65,000.00	2/1/2022		
8	Holly M.	Model RV322-19	$ 50,250.00	2/3/2022		
9	Holly M.	Model RV456-79	$ 75,000.00	2/15/2022		
10	Holly M.	Model RV442-13	$ 45,500.00	3/1/2022		
11	Holly M.	Model 235-25	$ 85,500.00	3/20/2022		
12	Holly M.	Model RV322-19	$ 50,250.00	4/2/2022		
13	**Holly M. Total**		$ 371,500.00			
14	**Holly M. Count**		6		18575	
15	Joe S.	Model RV322-19	$ 50,250.00	2/1/2022		
16	Joe S.	Model RV456-79	$ 75,000.00	2/17/2022		
17	Joe S.	Model RV442-13	$ 45,500.00	3/3/2022		
18	**Joe S. Total**		$ 170,750.00			
19	**Joe S. Count**		3		7683.75	
20	**Grand Total**		$ 662,750.00			
21	**Grand Count**		11			
22						

FIGURE 2-9: Specifying the TotalSales and ItemsSold arguments in the RV Sales worksheet. (Sample workbook: RV Sales.xlsx)



	A	B	C	D	E
1	**C&G RV Sales**				
2	**Salesperson**	**RV Sold**	**Amount of Sale**	**Date of Sale**	**Commision**
3	Fred R.	Model RV456-79	$ 75,000.00	2/3/2022	
4	Fred R.	Model RV442-13	$ 45,500.00	3/2/2022	
5	**Fred R. Total**		$ 120,500.00		
6	**Fred R. Count**		2		=
7	Holly M.	Model RV394-12	$ 65,000.00	2/1/2022	
8	Holly M.	Model RV322-19	$ 50,250.00	[illegible]	
9	Holly M.	Model RV456-79	$ 75,000.00		
10	Holly M.	Model RV442-13	$ 45,500.00		
11	Holly M.	Model 235-25	$ 85,500.00		
12	Holly M.	Model RV322-19	$ 50,250.00		
13	**Holly M. Total**		$ 371,500.00		
14	**Holly M. Count**		6		
15	Joe S.	Model RV322-19	$ 50,250.00		
16	Joe S.	Model RV456-79	$ 75,000.00		
17	Joe S.	Model RV442-13	$ 45,500.00		
18	**Joe S. Total**		$ 170,750.00		
19	**Joe S. Count**		3		
20	**Grand Total**		$ 662,750.00		
21	**Grand Count**		11		

Insert Function

Search for a function: Type a brief description of what you want to do and then click Go

Or select a category: User Defined

Select a function:

BoiteDialogueSolveurFinir
BoiteDialogueSolveurOk
PERSONAL.XLSB!Commission
DialoogOplosserBeëindigen
DialoogOplosserOk
OplosserBeëindigen
OplosserLaden

PERSONAL.XLSB!Commission(totalSales,itemsSold)

Calculates the sales commission based on the number of units sold.

FIGURE 2-10: Completed worksheet for all salespeople computed with the Commissions function. (Sample workbook: RV Sales.xlsx)

Assuming that cell C9 contains the total sales and cell C10 contains the number of items sold, Excel returns the #NAME? error value to the cell. If you then edit the function to include the Personal Macro Workbook's filename as follows

```
=PERSONAL.XLSB!Commission(C9,C10)
```

Excel calculates the sales commission based on the *TotalSales* in C9 and the *ItemsSold* in C10, returning this calculated value to the cell containing this user-defined function.

To be able to omit the filename from the custom functions that you create when you enter them directly into a cell, you need to save the workbook file that contains them as a special add-in file. (For details on using add-ins in Excel, see Book 1, Chapter 2.) Then, after you've saved the workbook with your user-defined functions as an add-in file, you can start entering them into any worksheet sans their filename qualifier by activating the add-in in the Add-Ins dialog box. (Press Alt+FTAA and then click the Go command button when Excel Add-Ins is displayed on the Manage drop-down list button.)

To convert a workbook containing the user-defined functions that you want to be able to enter into worksheets without their filenames, follow these steps:

1. **Unhide the PERSONAL workbook in which you've saved your user-defined functions in Excel by clicking the Unhide button on the View tab and then selecting PERSONAL followed by OK.**
2. **Choose Developer ⇒ Visual Basic (or press either Alt + LV or Alt + F11).**
3. **If the PERSONAL workbook isn't selected in the Project Explorer, click VBA Project (PERSONAL.XLSB) to select that project.**

   Now, you want to set up protection for this workbook so that only you can modify its contents.
4. **Choose Tools ⇒ VBAProject Properties from the Visual Basic Editor's menu bar.**

   This action opens the VBAProject — Project Properties dialog box with a General and a Protection tab, shown in Figure 2-11.
5. **Click the Protection tab and then click the Lock Project for Viewing check box.**

   Putting a check mark in this check box prevents other users from viewing the custom functions so that they can't make any changes to them.
6. **Click the Password text box, enter the password there, and then click the Confirm Password text box and re-enter the password exactly as you entered it in the text box above before you click OK.**

   A password prevents users from removing the view protection status.

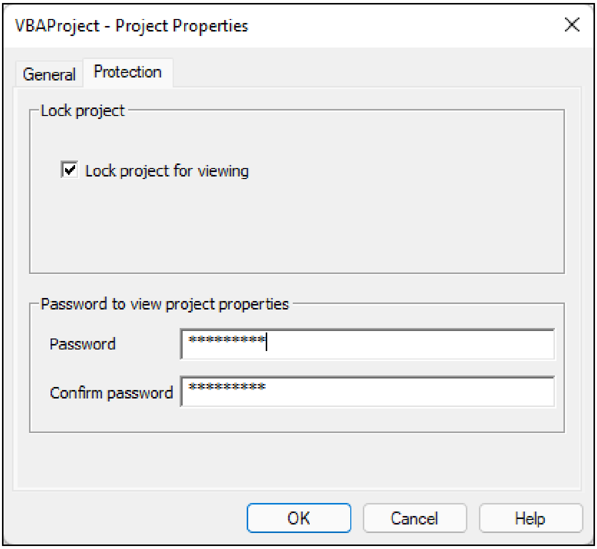

VBAProject - Project Properties
General
Protection
Lock project
☑ Lock project for viewing
Password to view project properties
Password
****
Confirm password
****
OK
Cancel
Help

FIGURE 2-11: Protecting the VBA project so that its user-defined functions can't be changed.

7. **Click the View Microsoft Excel button at the beginning of the Standard toolbar.**

   This action returns you to the worksheet in Excel. Before saving the workbook as an add-in, you should add a title for the user-defined functions that it contains. (This information then appears in the Add-Ins dialog box whenever you select the add-in file.)

8. **Choose File ⇒ Info.**

   Excel displays the Info screen about the workbook in the Backstage view.

9. **Click the Title text box and enter a descriptive title for the add-in, and then click the Save As option on the menu in the Backstage view.**

   This action opens the Save As screen where the XLSTART folder is currently selected.

10. **Click More Options.**

    Excel opens the Save As dialog box, where you need to change the file type to Excel Add-In (*.xlam) and then specify the filename (to which Excel automatically appends the `.xlam` filename extension) under which to save it.

11. **Click the Save as Type pop-up button and then select Excel Add-In (*.xlam) as the type.**
12. **Click the File Name combo box and make any necessary changes to the filename (without changing the `.xlam` filename extension) before you click the Save button.**

    After saving your workbook as an add-in file, you're ready to activate the add-in so that you can enter its user-defined functions in any worksheet.

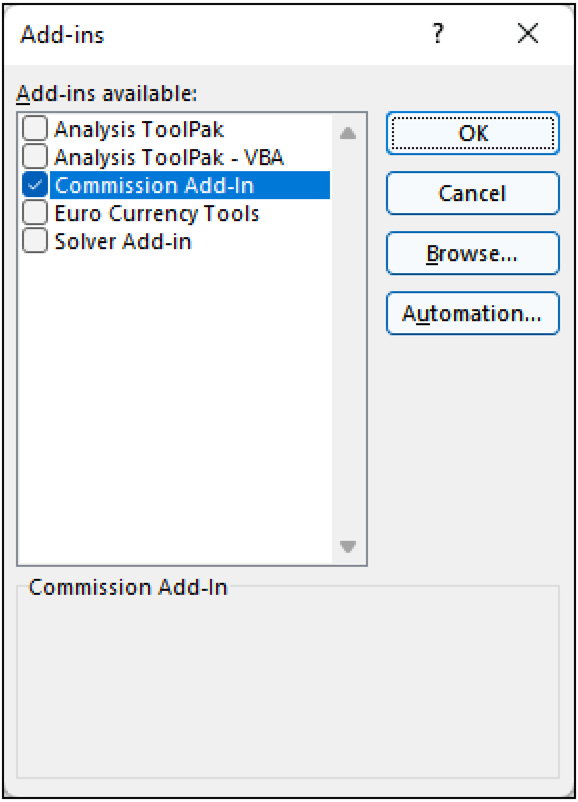
13. **Restart Excel.**
14. **Choose File ⇒ Options ⇒ Add-Ins or press Alt + FTAA.**
15. **Click the Go button near the bottom of the Add-Ins tab after checking to make sure that Excel Add-Ins is displayed on the Manage drop-down list button.**

    This action opens the Add-Ins dialog box showing the names of all the available add-ins. You must now add the name of your new add-in to this list.

16. **Select the name of your new add-in file in the Browse list box and then click OK.**

    This action closes the Browse dialog box and returns you to the Add-Ins dialog box that now lists your new add-in file. Now, all you have to do is make sure that the check box in front of the name of the new add-in (which displays the title and description you gave the add-in at the bottom of the Add-Ins dialog box) is selected before you click OK. (See Figure 2-12.)

17. **Select the check box in front of the name of the new add-in and then click OK.**



☐ Analysis ToolPak
☐ Analysis ToolPak - VBA
☑ Commission Add-In
☐ Euro Currency Tools
☐ Solver Add-in

FIGURE 2-12: Activating the new add-in file in the Add-Ins dialog box.

As soon as you click OK, Excel closes the Add-Ins dialog box and returns you to the VBA Editor window. You can then click the Save button (Ctrl + S) followed by the View Microsoft Excel button (Alt + F11) on the VBA standard toolbar. When you're back in the PERSONAL workbook, you can then hide it again by clicking the Hide button on the View tab (Alt + WH).

REMEMBER After that, you can start entering the custom functions that this add-in file contains directly into the cells of any worksheet without having to open the Insert Function dialog box.

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About the Authors

Paul McFedries has been a technical writer for 30 years (no, that is not a typo). He has been messing around with spreadsheet software since installing Lotus 1-2-3 on an IBM PC clone in 1986. He has written more than 100 books (nope, not a typo) that have sold more than four million copies worldwide (again, not a typo). Paul's books include the Wiley titles *Excel All-in-One For Dummies*, *Excel Data Analysis For Dummies*, *Teach Yourself VISUALLY Excel*, and *Teach Yourself VISUALLY Windows 11*. Paul invites everyone to drop by his personal website (`https://paulmcfedries.com`) and to follow him on Twitter (`@paulmcf`) and Facebook (`https://www.facebook.com/PaulMcFedries/`).

Greg Harvey authored tons of computer books, the most recent being *Excel 2019 For Dummies.* He started out training business users on how to use IBM personal computers and their attendant computer software in the rough-and tumble days of DOS, WordStar, and Lotus 1-2-3 in the mid-80s of the last century.

After working for a number of independent training firms, he went on to teach semester-long courses in spreadsheet and database management software at Golden Gate University in San Francisco.

Greg’s love of teaching translated into his equal love of writing. *For Dummies* books were, of course, his all-time favorites to write because they enabled him to write to his favorite audience, the beginner. They also enabled him to use humor (a key element to success in the training room) and, most delightful of all, to express an opinion or two about the subject matter at hand.

Greg passed away January 2020 after a multi-decade battle with cancer. This edition of *Excel All-in-One For Dummies,* and all subsequent editions of this work, are dedicated to his memory.

Dedication

To Karen and Chase, the best beings in the world.

Author’s Acknowledgments

If we’re ever at the same cocktail party and you overhear me saying something like “I wrote a book,” I hereby give you permission to wag your finger at me and say “Tsk, tsk.” Why the scolding? Because although I did write this book’s text and take its screenshots, that represents only a part of what constitutes a “book.” The rest of it is brought to you by the dedication and professionalism of Wiley’s editorial and production teams, who toiled long and hard to turn my text and images into an actual book.

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